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DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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MECHANICS' REGISTER.

JULY, 1840.

Practical and Theoretical Mechanics and Chemistry.

Arts and Artisans at Home and Abroad: with sketches of the progress of Foreign manufactures. By JELINGER C. SYMONS, Esq., *one of the assistant Commissioners on the hand-loom inquiry, &c.*

[CONTINUED FROM VOL. XXV. PAGE 374.]

Wages and Physical Condition of Austrian and Prussian Artisans.

In Austria but few differences distinguish the condition of the artisans from those in Germany. Since the period of a former visit to Austria, some years ago, I perceived a marked progress in their prosperity; and although small comparison can be drawn between the artisans of Switzerland and Austria, still those of the latter country are far from ranking low in the scale of industrial welfare among the nations of the Continent.

The wages of the factory labourers average as follows:—Spinners, 1 fl. (1*s.* 8*d.*) per day; women, from 30 to 40 kr. (10*d.* to *s* 1⅓*d.*) per day; children, 13 to 16 kr. (4⅓*d.* to 5⅓*d.*) per day.

The hours of factory labour in Austria are cruelly long, being frequently in the factories of the interior 15 hours per day, exclusive of meal time; and not unfrequently 17 hours. No law protects the children. At Messrs. Escher and Kennedy's, a humaner system is adopted, and the time of work seldom exceeds from 13 to 14 hours.

It appears that the fate of these unhappy children has excited some animadversion in Austria, and that the question of shortening the time of work is occupying the attention of the Government; for an association of the cotton spinners has been formed, to which, the owners of 470,000 out of the whole 600.000 spindles in the empire, already belong. The efforts of this associa-

tion are employed in using every possible means to keep the law as it is, and to maintain this flagrant inhumanity. This subject has been frequently recalled to my notice in other countries. Any remark which I might chance to make on the bad effects of not limiting the hours of infant labour in other factories, has been generally met by the remark, "We do not work our children nearly so much as in Austria." Thus the cruelty of the Austrian practice becomes a justification (though a bad one) for lesser excess over the rest of the continent.

The Wandershaft system of course prevails there; and most of the trades are supplied by the itinerant journeymen. A carpenter there can earn from 40 to 54 kr. and even a florin (1*s*. 8*d*.) per day. Millwrights ditto. The social system is very different from what it is in England or in Scotland, and it would take some time to describe it fully. In the first place, almost every father of a family has a house and several patches of land. The house and land may have cost 1200 to 1500 florins, or even less. 1200 fl. equals 100*l*. sterling, and this the proprietor has probably bought, liable to a mortgage of 600, 800, or even 900 fl.; for which he pays 5 per cent. The Voralberg. containing about 90,000 inhabitants, sends out masons and house builders to nearly the whole of Switzerland, and the neighbouring provinces of France. They leave early in spring, and live very sparingly during the summer; cooking for themselves a kind of pudding or soup of flour and Indian corn, which, with bread, and now and then a glass of wine, suffice for their nourishment. They return home in autumn, where they have little to do during winter; excepting to fell wood, &c. in the forests, and other chance work. The children leave the country at the same time in thousands, to herd cattle in Suabia and Bavaria: they get perhaps 1*l*., besides board and lodgings, for their services, a suit of home-spun linen clothes, and two pair of shoes, and perhaps a bag of flour, which they manage to cook for themselves on the way, and return with nearly the whole of their earnings. The women who remain, and the elder men, cultivate the land, and the girls and many of the young men weave, and are employed in the manufactories.

I have before stated, that food is cheap in Austria. These are the prices of bread and meat, and wheat, as published by authority in the "Feldkircher Wochenblatt," of October 9th, the day I was at that town; *Best wheat*, 6 fl. the half "metz," of which, four make a sack; (the price of the English quarter would be, therefore, 40*s*.) *common wheat*, $2\frac{1}{2}$ fl. per half metz, (or 33*s*. 4*d*. per quarter).

Best white bread,	$1\frac{2}{5}d.$ per	English lb.
Common do.	$1\frac{1}{6}d.$	Do.
Beef,	3*d*.	Do.
Veal,	3*d*.	Do.
Mutton,	$2\frac{3}{4}d.$	Do.
Pork,	4*d*.	Do.

In Austria, the working classes generally are a contented, but certainly an ill-informed people.

The means of life seem pretty equally distributed, according to the manufacturing demand for labour, or the fertility of the soil, compared with the number of the population. In the Tyrol, great poverty prevails, and this forces the natives to migrate and wander over the rest of the Continent, deriving a scanty subsistence from the sale of wares, &c.

In *Northern Prussia*, wages are not quite so high. Mechanics, as carpenters and blacksmiths, earn in the towns from 1*s*. 6*d*. to 1*s*. 10*d*. per day.

Shoemakers, tailors, &c., about 1*s.* 2*d.*: common labourers in towns 1*s.* per day in summer, and 9*d.* in winter, and in the country from 5*d.* to 8*d.* Agricultural labourers, besides house rent, fuel, and sometimes half an acre of land, earn from 5*d.* to 7*d.* per day.

The food of the working classes in Prussia does not materially differ from that of the Austrians.

In *Wurtemberg*, there are a great number of very poor people; chiefly owing, it is said, to the utter decay of the flax spinning, which, as a domestic industry, was the great trade of the Wurtemberg peasants. Weaving, and indeed all wages, have experienced a decline.

The best artisans are employed in the large towns, are fed and lodged by the masters, and receive from one to two and a half florins weekly. Those in the smaller towns and villages are lodged, fed, and receive from 20 kr. to 1 fl.; when workmen are taken on extraordinary occasions by the day, they receive from 20 to 30 kr., and are fed. Farmers hire their servants by the year, feed and lodge them, and give them in the villages from 20 to 40 fl., in the towns from 50 to 60 fl. yearly wages.

In the morning, they eat soup, potatoes, or bread; dinner, vegetables or pudding; between dinner and supper, bread; supper, potatoes and milk, or soup; once or twice a week, meat. In the cold weather, the man would have a glass of inferior brandy before going to work in the morning. On Sundays, the man would have a little beer or wine, and the woman coffee, of which they are very fond.

A journeyman workman in the country, with the shoemakers and tailors, 20, 24 to 30 kr.;* with the bakers, 48 kr. to 1 fl.; with the smiths, 48 kr. to 1 fl. 12 kr.; with calenderers and tanners, 48 kr. to 2 fl. weekly, with board: a journeyman carpenter, or bricklayer, from 30 to 36 kr. daily, with bread and something to drink. In the capital, with board, from 1 fl. 12 kr. to 2 fl. 42 kr. weekly; without board 36 kr. to 1 fl. daily.

It is astonishing how far these wages go. Day labourers even can save a great part of their earnings. They are well fed, when boarded by their employer; receive in towns, in the morning, coffee, 2 kr. worth of white bread, or, instead of the coffee, a quart of cider and a pound of bread; at dinner, every day, vegetables and meat; in the evening, soup, potatoes and two ounces of butter; in some trades they have, besides, a quart of cider and bread.

The country labourers also, in some places, live well. The return to the Poor Law Commissioners' Inquiry, states, that in the district called *Auf der Bahr*, for instance, every day labourer regularly kills a hog every year, either alone or in conjunction with others, and has meat through the winter. In the Black Forest every woodcutter in like manner constantly eats meat, drinks wine, and in general denies himself nothing. Other day labourers, who have fewer opportunities of obtaining constant work, or who have large families, must indeed live more frugally. A poor woodcutter at Delmensingen, in the bailiwick of Wiblingen, for instance, puts in the morning, a slice of bread in his pocket, and is happy if he can drink a small glass of brandy with it, and in the evening finds a dish of warm vegetables when he comes home; during the whole week he does not taste meat, and often not even on Sunday. A poor tailor at Saugau, whose business does not afford him the means, supports by day labour himself, his wife and eight children, who, on account of their youth or attendance at school, can earn little or

* 60 kreutzers make 1 florin = 1*s.* 8*d.*

nothing; that is, ten persons, without incurring debts and without support from others, except perhaps a few articles of clothing which are given them as presents. The work on which he is employed is chiefly woodcutting and *stumpengraben*, by which he earns, one day with another, at the most, 24 kr. or 120 fl. per annum. These people take, in the morning, soup; when the man goes into the forest, he takes with him brandy to the value of $1\frac{1}{2}$ kr. and black bread, for 2 kr., and in the evening sups with his family, who, during the day, have had potatoes, or *garlic* and herbs, or some other vegetable, or perhaps potatoes again. These people taste meat at the most sometimes on Sundays; never wine or beer.

The prices of food are extremely low in Wurtemberg: coarse meat costs on an average 8 kr. per lb.,$=2\frac{2}{3}$*d.*, bread from 3 to 4 kr.,$=1\frac{2}{3}$*d.* per lb.

A Review of Wages.

As the amount of commodities purchasable with the same sum of money on the Continent, is much greater than the amount purchasable with it in England, various calculations have been made of the proportionate difference; but as this amount of commodities differs not only between countries but between towns and districts in the same countries, I regard as of very little use any statement of one general measure of a difference, which I have found to vary with the price of food, the fluctuations of markets, the inequality of seasons, and the political circumstances of the countries, from a difference of 5 per cent., to a difference of 100 per cent. It is necessary to specify the place in each country, and the time at which the comparison is to be made, in order to arrive at any thing like a correct ratio of the proportionate value of the same sum at those places. As a general proportion (subject, however, to large variations,) we may perhaps assume that in Switzerland 1*s.* will go as far for a working man as 1*s.* 3*d.* here; in France, Belgium, Rhenish Prussia, as far as 1*s.* 4*d.* here; in Austria, and many parts of Prussia, as far as 1*s.* 5*d.* here; and in Wurtemberg, parts of Austria, some of the Duchies, and Bohemia, as far as 1*s.* 8*d.* or 1*s.* 10*d.* here; always comparing towns with towns, and country with country; agricultural with agricultural districts, and manufacturing with manufacturing districts. Hereafter, of course, in using the term wages, I mean *real* wages, that is, *amount of commodities* purchasable with the money.

It will be seen that one of the most salient features of difference between home and continental wages, consists in the fact, that, whilst very great disparity exists between the rates of payment in the different departments of labour at home, an uniformity prevails abroad, varied alone by the variations of skill required, and by the local demand for and supply of labour. It will be further observed, that the branches of industry which are higher paid with us than abroad, such as spinners, tailors, &c., are precisely those which are in combination among us; and that those, such as hand-loom weavers, &c., who are worse paid here than abroad, are those who have no combinations, at least none effective in maintaining the rate of wages. To this fact, I shall recur hereafter; for to the absence of combinations abroad I entirely attribute the uniformity of foreign wages. Taking a general view of the comparative pecuniary condition of the working-classes on the Continent and at home, I have no hesitation in saying, even after the difference in value of money is taken fully into account, that the working-classes of England in the aggregate, are at least by one-sixth better off than the working-classes of the Continent. Of course, this statement is subject

to very considerable exceptions, which I shall endeavor to specify; but as a general statement I make it with confidence.

The factory work-people are decidedly the best paid in England, in comparison with the same class abroad. The wages in the Lancashire factories average as I have stated 10*s.* 6*d.* per week per head. Those in France, Switzerland, Austria and Belgium, vary from 6 fr. to 9 fr., averaging 7 fr. 50 cent. =6*s.* 3*d.*—a sum which will, in the districts in questions, be equivalent in exchangeable or real value to 8*s.* 4*d.*; so that cotton-factory work-people of Lancashire have 26 per cent., or a quarter more wages than the same class abroad. The disparity is *less* in all other branches of industry; and the difference, with scarcely an exception, will be found to *decrease* in each branch of industry, in the same proportion in which that branch is unfortified by combinations at home;—the journeymen carpenters, tailors, shoemakers, differing in a lesser degree, the agricultural wages differing very little, and the hand-loom weavers being somewhat higher abroad.

The price of corn, and therefore of the chief articles of food, in France and Belgium, is, for instance, to the price in England, as 3 is to 4, or as nearly so during a course of years as possible. Taking this as a groundwork, I have sketched the following proportion between real wages, in the chief divisions of industry in the two countries :—

Classes of Labourers.	In France and Belgium, Average Weekly Wages.	In England, Average Weekly Wages.	Difference in favour of England, after adding one-third for greater cost of food.
	fr. cent. *s. d.*	*s. d.*	*s. d.*
1st Class of Mechanics.	15 =12 06	20 00	3 04
2d do. do.	10 80 = 9 00	14 00	2 00
Farm Labourers.	7 80 = 6 06	10 00	1 04
Spinning Factory do. men, women, and children.	7 50 = 6 03	10 06	2 02

In Switzerland, the paradise of the labouring classes, where the father of almost every family is a proprietor of land, the condition of the working-classes cannot be tested by wages, and their high physical, as well as moral eminence, places them far above the standard of comparison with any other people of Europe. In France, wages I consider are, generally speaking, as low if not lower than in most countries; and the people live in a state of discomfort, which I have not seen surpassed, except in portions of the most impoverished parts of Austria and Wurtemberg.

The comfort of the cottages in England is not equalled abroad, Switzerland excepted. In Belgium there is more cleanliness than in France; the pigs and poultry have not the same prescriptive right to inhabit the bedrooms, which they possess by immemorial usage in most other countries. In Austria the physical comfort of the working classes is a little superior to that of the French. I have compared these countries with England, in

distinction from Scotland, where I found every thing, as regards the country especially, so closely resembling the scenes, practices and manners of the Continent, especially Germany, that I regard it in these respects on a par with Prussia.

The Mental and Moral Condition of the Artisans Abroad.

In education Belgium is decidedly deficient: about one-third of the children are wholly ignorant. The schools are of three classes, viz. communal, *mixte*, and private. The first are schools supported by the local municipal funds; *ecoles mixtes* are also communal schools, but which derive aid or subsidy from the Government or the province. About 400,000 children are receiving education out of a population of 4,250,000, the average being one child educated to 10.7 of the population.

The following table presents a relative view of the education, criminality, poverty, density of population, proportion of town to country inhabitants, gross population, births and deaths, in each of the nine provinces of Belgium. I have carefully collated it from state documents.

Provinces.	Inhabitants to every one Child at School.	Inhabitants to every one Person accused of Crimes.	Number of indigent Poor to ev'ry 100 Inhabitants.	Number of Country Inhabitants to every one in Towns.	Inhabitants to ev'ry 100 Hectares.*	Total Births in 1836.	Total Deaths in 1836.	Gross Population in 1836.
Namur	6.8	6,369	4.4	5.80	62.5	7,554	4,268	227,074
Luxemburg	7.1	8,407	0.7	6.59	47.8	11.752	7,421	323,219
Brabant	9.4	5,924	21.1	2.60	180.4	21,319	15,536	592,250
Hainault	9.5	17,111	21.3	3.79	175.4	21,192	13,432	631,823
Anvers	9.7	6,138	7.9	1.90	126.8	7,493	8,482	360,180
Limburg	10.2	5,924	10.0	4.16	76.9	9,219	7,598	331,305
E. Flanders	12.6	5,734	13.3	3.10	253.2	24,090	17,933	758,906
W. Flanders	13.9	6,686	20.1	2.76	191.0	21,586	16,689	627,128
Liege.	16.2	5,440	17.2	3.09	135.4	14,372	9,875	390.715

The average of children at school was less favourable in 1833, when the census gave 11.3 inhabitants to every child at school. The year chosen for the preceding table was 1836 Namur and Luxemburg presented the largest amount of education in 1833, and the two Flanders the least. There are several infant and adult schools in Belgium, conducted on a very efficient scale.

It will be perceived that Liege presents the most ignorance, the most crime, and nearly the greatest proportion of paupers. It is singular that Liege, together with Brabant and Hainault, are the richest provinces, and those where wages are the highest! If I attempted to explain this, I should say that it arose more probably from the culpable indifference to the morals and minds of the people, on the part of those who are at the head of large establishments, in more than one of the districts in question. However this may be, I have always found that high wages, without a pro-

* Nearly two and a half acres each.

portionate mental training, were invariably attended with increased immorality, imprudence, and frequently with positive want.

The Progress of the Manufacturing Arts Abroad, as regards Machinery.

Machinery is the main agent of manufactures, and no surer index of the progress of the latter can be adduced than the advances of the former. I am, I confess, not among the number of those who magnify the relative importance of the *existing* circumstances and extent of foreign competition; but I should be wilfully blind to the plainest evidences of the truth, were I to conceal that there are symptoms throughout the Continent of a prospective, and by no means a remote, rivalry with this country in the chief of those arts of production and elements of commerce in which England has heretofore maintained a perfect and facile pre-eminence. The peril to this country is to be measured not by present competition, but by the magnitude of the preparations, and the germs of a progress which is as yet confined to a promising and vigorous infancy, evidenced chiefly by the rapid increase of machine-making establishments, to a slight description of which I shall devote this chapter.

Belgium, from her mineral riches and other topographical facilities, naturally takes the lead in the progress of Continental machinery. I have already alluded to the leviathan establishment of Mr. John Cockerill at Seraing, employing 3000 workmen, with seven skilful English engineers superintending the chief departments, and combining English skill with the advantages of cheap labour. The motive power consists of steam-engines of 900 horse power; and Mr. Cockerill not only supplies machinery to all parts of the Continent, but has branch establishments in three different countries. In addition to spinning machinery of every description, steam-engines, both stationary and locomotive, are supplied to France, Germany and Russia.

It is difficult to name any large enterprise of manufacturing industry, whether in Belgium, Holland, Russia, or the immense territory of the Prussian league, with which Mr. Cockerill is unconnected, either as a shareholder or as the engineer from whom the machinery emanates. He has spinning-mills of flax, or cotton, or wool, in almost all the chief districts for these manufactures in the Prussian or Belgian dominions. Mr. Cockerill's name is on all the locomotive* engines on the Belgian railroads, and I was told that he is the contractor for those now forming in Russia.

When we remember that Mr. Cockerill's father, who established this gigantic concern, came over to Belgium a common blacksmith, and could neither write nor read, I believe, till the day of his death; when we further consider that the machinery he turns out is, after all, of secondary reputation for quality, and extremely dear, we may form some idea of the power and magnitude of the natural advantages Belgium affords to the manufacture of machinery, and which may be reckoned as the multiplier of all her other productive powers.

Mr. Cockerill, extensive as are his enterprizes, by no means monopolizes the making of machinery. Of those now commencing there are the Messrs. Fairburn, who have issued prospectuses of an establishment, which was to be formed at the large factory already built at Malines, near the

* A. D. 1837.—C. P.

railroad station. Mr. William Fairburn is to superintend the heavy department for engines, locomotives, &c., and Mr. Peter Fairburn that for spinning-machinery, and especially for flax spinning. There can be no question that this establishment will rival any in England. In addition to these is the company of the Phenix at Gand, on a very large scale, and in which English and Scotch engineers are already engaged. There is likewise another at Brussels, of the existence of which some mystery is made. I owe the knowledge of it to Sir Hamilton Seymour, who kindly accompanied me to see it, and owing to his good offices we obtained the unusual favour of being allowed to inspect the interior. It is of large dimensions, covering 2½ bonniers of about 6500 square feet each. This establishment belongs to one of the *Sociétés anonymes*, of which the Banque Nationale is said to be at the head. 500 workmen, of nearly all nations except France, whose operatives are not in repute in Belgium, are employed. Some of Sharp and Robert's machinery was there. The present motive power is not above 36 horse.

There are several old established machine-makers in different towns in Belgium, but few on the same scale as those I have named. The fact is, that this industry is yet in the first stage only of its development. Mr. Cockerill told Sir Hamilton Seymour, that he had all the new inventions over at Seraing ten days after they came out in England.

There is but one chance of an obstacle to the career of Belgium in her manufacturing progress of competition with England, and that one Her Majesty's Government have recently, no doubt with the best intentions, used their best exertions to remove, exertions which have met with the best reception and success on the part of Belgium. I allude to the decreasing stock and increasing price of coal in that country. The following table of its rapid rise in price is extracted from statistical government returns.

	1836.	1837.
Mons,	7 and 8 fr. per tonne.	12 and 14 fr. per tonne.
Charleroi,	13 and 14 fr. id.	18 and 19 fr. do.

Prior to 1836, Mons coal was 8 fr. per tonne at the *maximum*. It has risen in price again since last year; and the Belgian Government have consequently assented to the prayer of the English Government, to be allowed to supply them free of duty.

By France a similar *boon* has been granted to the coal-owners in England, and I need hardly say that the Belgian and French manufacturers are overjoyed at the concession.

The iron-works have made equal progress in Belgium.

In 1837, there were 23 high furnaces of coke, and 66 of charcoal, in Belgium; 20 new furnaces of coke are either completed or being erected since that period. On the plain of Selessin near Liege, a company are erecting six of a colossal magnitude, which, when finished, will be the largest on the Continent.

The quantity of iron founded in the year in Belgium was estimated at 150,000 tonnes (or about 147,640 English tons.) It is now increased.

The following are the current prices of iron per *tonne*.

	1st Quality.	2d Quality.
1830,	465 fr.	390 fr.
1832,	412 fr.	322 fr.
1834,	393 fr.	304 fr.
1836,	413 fr.	324 fr.

In France, machine-making is proceeding with considerable rapidity. Mr. Dyer of Manchester has established his son at Blangy, not far from Abbeville, and there are many French competitors. There is one especially at Reims, who turns out excellent machinery, and many at St. Etienne.

At Zurich in Switzerland, there is a first-rate establishment of this sort, where iron steam-boats, down to the finest spinning machinery, are manufactured. There are nearly 700 workmen employed here, and 7 are English foremen. Mr. Escher, who is one of the first and most scientific industrialists of the Continent, is at the head of this establishment, and, like Mr. Cockerill, is also the proprietor of several flourishing steam-factories, some paper-mills, and some weaving and some spinning-mills, not only in Switzerland, but in Piedmont, Savoy, the Tyrol, and Wirtemburg, where he is about to erect a flax-factory. Mr. Peter Kennedy, late of Manchester, is in partnership with him, and superintends the Austrian mills. New inventions are frequently made. For instance, I saw a roller introduced at the end of the carding-frames, round which the cards are wound, and which dispenses entirely with the pans, and consequently with a great number of hands still employed in most, if not in all, of the English mills. Again, they are enabled to unite the separate advantages of different patents in England; and at Mr. Escher's factory in Zurich I saw a combination of the self-acting mules severally produced by Sharp and Roberts, and Mr. Smith of Deanston, and which their patents prevent our combining in England.

Many of the foreign mechanics, who have not an equal skill in the invention or improvements of machinery, directly pirate the productions of English skill. An English gentleman told me he had assisted in putting together some new machinery in Italy, which had been cast in moulds formed from some smuggled machinery of the Messrs. Crichton, with their name and the word Patent cast on it.

At Vienna the emperor has a large establishment under his immediate patronage, and an Englishman of the name of Thomson is one of his chief superintendents. The Emperor of Russia has very large foundries and spinning-factories at Alexanderoffsky, with a General Clark at the head of the foundry, and a Mr. Wilson of the factories, and at Colpenny with several English workmen. Wilson, brother of the above named, is the foreman or superintendent at St. Petersburg; the foundry is chiefly for cannon. John Isherwood, formerly of Leeds, is at the head of another establishment called Waybugskey, a part of the capital.

The following information on the denizen mechanical skill in Poland is from a perfectly authentic source.

A large mill, having sixteen pair of mill-stones, moved by steam-power, and lighted with gas, was erected at Warsaw some years ago. It was at first managed by a native of France, under whose management it did not succeed. For the last six years, a Mr. Kedslie, mill-factor from Leith, has been the superintendent, and he has taken out two millers and their families from the mills on the water of Leith; the mill is now working day and night, and succeeding well. All parties concerned there are said to be much pleased that the bill to grind bonded grain has been thrown out by the British House of Commons. They fear nothing so much as British capital, machinery, and skill, to compete with them. John Douglas and nephew from Edinburg, established thrashing-machines and paper-mills in Poland, and have now settled as paper-mill proprietors in that country.

Since the last rebellion in Poland, James Garvie and Son, also Thomas Garvie, shawl manufacturers from Edinburgh, have succeeded in establishing a shawl manufactory thirty miles from Warsaw, upon the estate of Count Lubenski, President of the Board of Trade there: the factory consisted of thirty looms in the month of September, 1836. This same Count has erected a spinning-mill for flax, 300 feet long, 100 feet wide, 3 flats in height, and has 200 looms at work, weaving table-cloths, toweling, and linens; also thirty shawl looms, in the month of September, 1836. The yarn all spun by his own mill.

Thomas Garvie has engaged to be his overseer for the weaving department, and left the shawl factory to his brother James and Son, who are doing well.

Mr. Prichard from Edinburgh, now engineer to the Government zinc mines in Poland, was in Scotland two years ago, at which time he engaged a bleacher from Perthshire, who has commenced bleaching to the above establishment. This is the first attempt at bleaching in Poland.

Mr. George Blackie, engineer, from Edinburgh, is now employed on canals and public roads by the Government of Poland.

At Prussian Bohemia, at Aix in Prussia, and in Saxony at Chemnitz, there are also machine-making establishments. In fact, they are rising in all parts of the Continent with a rapidity, and to an extent, very far disproportioned either to the growth of the population or to the progress of preceding years. (TO BE CONTINUED.)

Physical Science.

The Committee on Meteorology have received from their correspondent at Lancaster, the following complete summary of observations for the year 1839. As it is a paper of much interest to meteorologists, it is presented to the readers of the Journal entire; and other observers are invited to furnish similar condensed statements for publication.—COM. PUB.

Meteorological Journal for the year 1839, *kept at the Lancaster Conservatory of Arts and Sciences, Lancaster, Pennsylvania; by* WASHINGTON L. ATLEE, M. D., *Observer.*

Remarks.—The Thermometers are all graduated by Fahrenheit's scale. The Barometer, Thermometers, and Rain Gauge are 5 feet from the ground. The wet-bulb Hygrometer is a common Thermometer, whose bulb is enveloped in a white cotton rag, made wet and fanned in the air. The Dew-point is ascertained sometimes by means of a tumbler of cold water, and sometimes by calculation from the wet bulb Hygrometer. The sky is called entirely clear when no vestige of cloud can be seen; entirely cloudy when no vestige of sky can be seen; and partly clear when both sky and clouds can be seen. The direction of the wind is ascertained by vanes and by smoke. The N. N. E. winds are placed under the general head of N. E. The N. N. W. under N. W. The S. S. E. under S. E. And the S. S. W. under S. W. The force of the wind, although regularly noted, is not given in this table. The direction of the clouds is always noted when it can be ascertained. Sometimes a stratum of clouds is so uniform and unbroken that no movement can be detected, and at night their direction can seldom be discovered. The force of the clouds' motion is also regularly noted, but not given in the above table.

Lancaster, May 4, 1840. WASHINGTON L. ATLEE, M. D., Observer.

Meteorological Journal for 1839, *kept at the Lancaster Conservatory of Arts & Sciences, Lancaster, Pa., by* WASHINGTON L. ATLEE, M. D., *Obs.*

		BAROMETER.			THERMOMETER.					HYGR'M'TR, 2 P.M.			SKY.				WINDS.				CLOUDS.			RAIN.
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff. bet. dew pt. &therm.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Guage Inches
JANUARY.	Average	29.53	29.52	29.55	23.22	34.11	26.98	21.19	27.62	24.82	9.22	31.58					N.	1	1	1	1	1	0	
																	N. W.	7	10	12	12	8	4	
	Maximum	30.28	30.32	30.24	46.00	58.50	41.00	34.00	46.25	52.93	20.60	55.50	Ent. clr	3	5	10	N. E.	8	8	8	0	0	0	
																	S.	2	0	1	1	1	0	
	Minimum	28.89	28.56	28.78	−2.25	12.00	5.50	−2.25	10.625	−8.60	0.00	10.00	Ent.cld	15	13	14	S. W.	8	5	2	1	2	2	
																	S. E.	4	7	6	1	0	1	
	Range	1.29	1.76	1.46	48.25	46.50	35.50	36.25	35.625	61.53	20.60	45.50	Prt. clr.	13	13	7	W.	1	0	0	1	9	0	
																	E.	0	0	1	7	0	0	
	Omitted																				6	8	14	5.143
FEBRUARY.	Average	29.58	29.54	29.56	27.26	39.07	30.21	25.78	31.89	29.43	9.00	35.88					N.	1	1	2	0	0	0	
																	N. W.	6	7	6	6	9	1	
	Maximum	29.90	29.85	29.92	38.50	54.50	41.00	36.50	42.75	51.59	24.95	46.00	Ent.clr.	8	2	16	N. E.	9	4	6	1	0	0	
																	S.	0	1	0	0	0	0	
	Minimum	28.96	28.68	28.71	8.00	18.50	13.00	8.00	13.25	−5.60	0.00	15.00	Ent. cld	7	9	8	S. W.	7	6	7	3	4	2	
																	S. E.	5	7	7	1	1	0	
	Range	.94	1.17	1.21	30.50	36.00	28.00	28.50	29.50	57.19	24.95	31.00	Prt. clr.	13	17	4	W.	0	1	0	7	6	2	
																	E.	0	1	0	0	0	0	
	Omitted																				3	7	8	3.885
MARCH.	Average	29.51	29.49	29.51	35.76	50.14	39.84	32.71	41.437	32.63	17.65	42.27					N.	3	1	2	1	3	0	
																	N. W.	11	5	7	5	6	1	
	Maximum	30.04	30.03	29.92	61.00	79.00	59.00	57.00	67.00	47.44	48.21	60.00	Ent.clr.	11	11	19	N. E.	1	3	1	0	1	0	
																	S.	4	2	0	1	0	0	
	Minimum	29.07	28.89	28.95	10.00	23.00	14.00	9.75	16.375	7.55	0.00	20.00	Ent. cld	6	6	5	S .W.	5	6	4	1	0	1	
																	S. E.	3	4	4	1	1	0	
	Range	.97	1.14	.97	51.00	56.00	45.00	47.25	50.625	39.89	48.21	40.00	Prt. clr.	14	13	4	W.	0	0	2	7	5	2	
																	E.	0	0	0	0	0	0	
	Omitted		1	3		1	3		1	2	2	1			1	3		4	10	11	6	5	5	1.006

Meteorological Journal—Continued.

		Barometer.			Thermometer.					Hygr'm'th, 2 P.M.			Sky.			
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff. bet. dew pt. &therm.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days
April.	Average	29.50	29.47	29.47	47.04	65.53	53.27	43.10	54.22	43.62	21.71	54.02				
	Maximum	29.81	29.78	29.78	59.00	78.50	65.00	56.75	64.375	59.83	35.21	66.00	Ent. clr	11	12	13
	Minimum	28.88	28.94	28.89	31.50	44.00	39.00	29.50	41.25	26.40	0.00	43.50	Ent. cld	11	5	8
	Range	.93	.84	.89	27.50	34.50	26.00	27.25	23.125	33.43	35.21	22.50	Prt. clr.	8	13	9
	Omitted															
May.	Average	29.44	29.43	29.42	56.77	71.89	61.32	53.84	62.88	48.34	22.83	60.21				
	Maximum	29.68	29.68	29.67	69.50	84.50	72.50	65.50	74.00	67.48	43.49	72.00	Ent. clr	7	5	15
	Minimum	29.05	29.04	29.07	40.50	57.50	48.00	37.00	50.50	19.32	3.08	45.00	Ent. cld	5	4	8
	Range	.63	.64	.60	29.00	27.00	24.50	28.50	23.50	48.16	40.41	27.00	Prt. clr.	19	21	8
	Omitted		1			1			1	3	3	3			1	
June.	Average	29.42	29.42	29.42	60.65	72.06	63.89	58.12	65.13	58.28	13.47	63.77				
	Maximum	29.67	29.68	29.69	71.50	84.00	76.00	71.50	75.50	73.32	24.09	75.00	Ent. clr	7	2	10
	Minimum	29.16	29.19	29.16	50.00	57.25	53.00	49.00	53.125	46.14	0.00	54.00	Ent. cld	8	9	9
	Range	.51	.49	.53	21.50	26.75	23.00	22.50	22.375	27.18	24.09	21.00	Prt. clr.	15	18	11
	Omitted		1			1			1	1	1	1			1	

	Winds.				Clouds.			Rain.
		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Guage Inches
April.	N.	2	3	4	3	3	0	
	N. W.	8	7	6	4	2	2	
	N. E.	7	6	5	1	1	0	
	S.	2	4	4	0	0	0	
	S. W.	7	6	7	2	2	1	
	S. E.	1	0	0	1	1	0	
	W.	0	2	1	2	5	1	
	E.	3	2	2	0	0	0	
				1	6	4	13	6.030
May.	N.	1	2	1	0	0	0	
	N. W.	8	8	6	8	7	2	
	N. E.	3	4	4	0	0	0	
	S.	2	3	4	0	0	0	
	S. W.	9	4	7	6	4	2	
	S. E.	2	4	5	1	3	1	
	W.	2	5	3	10	10	4	
	E.	4	1	1	1	0	0	
					2	2	8	3.175
June.	N.	4	4	3	1	1	0	
	N. W.	9	9	8	9	11	1	
	N. E.	3	2	3	2	2	0	
	S.	3	3	3	1	1	0	
	S. W	5	9	5	5	2	2	
	S. E.	2	1	4	1	3	0	
	W.	4	1	4	7	9	4	
	E.	0	1	0	0	0	0	
					1		13	4.630

		Barometer. 7 A.M.	2 P.M.	9 P.M.	Thermometer. 7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Hygr'm'tr, 2 P.M. Dew point.	Diff. bet. dew pt. & therm.	Wet bulb.	Sky.	7 A.M Days	2 P.M Days	9 P.M Days
July.	Average	29.49	29.48	29.48	69.55	81.30	71.14	66.14	73.88	65.73	15.52	70.79				
	Maximum	29.78	29.77	29.76	77.50	91.00	79.00	75.25	79.625	77.48	28.24	79.50	Ent. clr	10	0	8
	Minimum	29.20	29.17	29.16	61.00	70.50	63.00	56.00	63.50	50.76	0.00	60.00	Ent.cld	4	3	6
	Range	.58	.60	.60	16.50	20.50	17.00	19.25	16.125	26.72	28.20	19.50	Prt. clr.	14	25	13
	Omitted													3	3	4
August.	Average	29.52	29.51	29.53	66.23	77.43	68.38	63.04	70.44	61.54	12.32	68.48				
	Maximum	29.77	29.76	29.74	74.50	87.00	79.00	73.00	80.00	76.24	26.16	78.00	Ent. clr	6	1	7
	Minimum	29.13	29.24	29.19	53.50	58.50	57.00	50.50	56.75	51.79	0.00	55.00	Ent.cld	9	4	5
	Range	.64	.52	.55	21.00	28.50	22.00	22.50	23.25	24.45	26.16	23.00	Prt. clr.	16	25	17
	Omitted		1			1			1	2	2	2			1	2
September.	Average	29.53	29.51	29.53	57.08	73.30	62.00	54.69	63.66	57.72	13.91	63.99				
	Maximum	29.82	29.83	29.83	76.00	86.00	75.50	74.00	80.00	75.14	24.61	76.50	Ent. clr	14	5	15
	Minimum	29.20	29.18	29.24	40.50	55.00	40.00	38.00	47.50	37.81	1.36	47.50	Ent.cld	4	3	6
	Range	.62	.65	.59	35.50	31.00	35.50	36.00	32.50	37.33	23.25	29.00	Prt. clr.	12	22	7
	Omitted			2			2									2

	Winds.	7 A.M Days	2 P.M Days	9 P.M Days	Clouds. 7 A.M Days	2 P.M Days	9 P.M Days	Rain. Rain Gauge Inches
July.	N.	5	1	3	1	1	2	
	N. W.	11	8	4	6	7	3	
	N. E.	0	0	3	0	0	0	
	S.	7	5	6	0	1	0	
	S. W.	7	10	9	3	3	1	
	S. E.	0	2	3	1	1	0	
	W.	0	5	2	10	15	3	
	E.	1	0	0	0	0	0	
	Omitted			1	3	4	14	2.608
August.	N.	1	1	1	2	1	0	
	N. W.	7	3	4	2	5	2	
	N. E.	11	9	9	3	4	0	
	S.	1	2	3	2	2	2	
	S. W.	4	5	5	5	8	4	
	S. E.	3	3	3	2	3	2	
	W.	2	3	0	5	6	1	
	E.	1	2	3	2	0	1	
	Omitted	1	3	3	3	3	12	3.135
September.	N.	3	1	1	1	1	0	
	N. W.	6	8	6	2	4	1	
	N. E.	3	4	4	0	1	0	
	S.	1	2	1	0	2	0	
	S. W.	11	10	9	6	3	1	
	S. E.	3	2	4	1	1	0	
	W.	3	3	3	6	12	1	
	E.	0	0	0	1	1	0	
	Omitted			2	1	1	12	3.198

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Month		Barometer. 7 A.M.	Barometer. 2 P.M.	Barometer. 9 P.M.	Thermometer. 7 A.M.	Thermometer. 2 P.M.	Thermometer. 9 P.M.	Thermometer. Reg'r.	Thermometer. Mean.	Hygr'm'tr, 2 P.M. Dew point.	Hygr'm'tr, 2 P.M. Diff bet. dew pt. & therm.	Hygr'm'tr, 2 P.M. Wet bulb.	Sky.	Sky. 7 A.M Days	Sky. 2 P.M Days	Sky. 9 P.M Days	Winds.	Winds. 7 A.M Days	Winds. 2 P.M Days	Winds. 9 P.M Days	Clouds. 7 A.M Days	Clouds. 2 P.M Days	Clouds. 9 P.M Days	Rain. Rain Gauge Inches
October.	Average	29.69	29.66	29.67	49.56	67.07	54.97	47.48	57.278	51.97	14.97	58.68					N.	5	3	3	2	3	0	
																	N. W.	3	3	5	2	6	0	
	Maximum	30.09	30.09	30.08	64.00	80.00	69.00	60.00	69.00	67.52	28.70	69.00	Ent. clr	15	8	17	N. E.	3	5	4	2	1	0	
																	S.	4	4	6	0	0	0	
	Minimum	29.28	29.31	29.25	32.00	51.00	38.00	30.00	41.625	34.62	0.00	44.00	Ent.cld	8	5	8	S. W.	5	6	2	3	5	0	
																	S. E.	3	5	4	1	4	0	
	Range	.81	.78	.83	32.00	29.00	31.00	30.00	27.375	32.90	28.70	25.00	Prt. clr.	8	18	6	W.	1	1	2	4	5	2	
																	E.	7	4	5	0	1	0	
	Omitted																				2		12	1.305
November.	Average	29.56	29.53	29.54	32.88	45.76	36.70	31.62	38.67	31.59	13.92	40.19					N.	2	2	2	0	0	0	
																	N. W.	8	9	11	5	9	3	
	Maximum	30.12	30.13	30.16	46.00	60.00	55.00	51.00	54.75	56.71	24.46	57.50	Ent. clr	8	6	10	N. E.	5	4	5	1	0	0	
																	S.	0	2	1	1	1	1	
	Minimum	28.96	28.93	28.92	14.50	25.00	19.00	14.00	19.50	5.38	0.00	21.00	Ent.cld	6	6	8	S. W.	5	4	4	5	6	0	
																	S. E.	3	3	4	2	0	0	
	Range	1.16	1.20	1.24	31.50	35.00	36.00	37.00	35.25	51.33	24.46	36.50	Prt. clr.	15	17	12	W.	5	4	3	5	5	1	
																	E.	1	1	0	0	2	0	
	Omitted	1	2		1	2			2	2	2	2		1	1			1	1		3	2	15	2.230
December.	Average	29.33	29.28	29.30	31.13	39.10	31.39	27.49	34.16	30.63	8.94	36.48					N.	3	2	3	0	2	0	
																	N. W.	13	12	12	11	11	4	
	Maximum	29.66	29.61	29.65	44.00	56.00	46.00	43.00	45.75	47.50	22.39	48.50	Ent. clr	3	2	10	N. E.	9	7	8	5	3	0	
																	S.	0	2	1	1	0	0	
	Minimum	28.30	28.46	28.23	15.50	25.00	20.00	15.00	20.00	8.24	0.00	21.50	Ent.cld	16	18	16	S. W.	3	1	2	3	4	0	
																	S. E.	1	1	1	0	0	0	
	Range	1.36	1.15	1.37	28.50	31.00	26.00	28.00	25.75	39.26	22.39	29.00	Prt. clr.	12	10	5	W.	2	4	4	3	2	0	
																	E.	0	1	0	1	2	0	
	Omitted		1			1	1		1	3	3	3			1				1		4	6	17	3.460

	Average of 1839.										
	Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.		
	7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff. bet. dew pt. &therm.	Wet bulb.
1839. Average	29.51	29.49	29.50	46.43	59.71	50.00	43.77	51.77	44.69	14.45	52.19
Maximum	30.28	30.32	30.24	77.50	91.00	79.00	75.25	80.00	77.48	48.21	79.50
Minimum	28.30	28.46	28.28	–2.25	12.00	5.50	–2.25	10.625	5.38	0.00	10.00
Range	1.98	1.86	1.96	71.75	79.00	73.50	77.50	69.375	72.10	48.21	69.50
Omitted	1	7	5	2	7	6		7	13	13	12
	Average of Winter Months 1838–39.										
Winter, 1838–39. Average	29.48	29.45	29.47	27.20	37.43	29.53	24.79	31.09	34.96	8.72	34.65
Maximum	30.28	30.32	30.24	44.00	60.00	46.00	43.00	45.75	52.93	24.95	55.50
Minimum	28.30	28.46	28.28	–2.25	12.00	5.50	–2.25	10.625	5.60	0.00	10.09
Range	1.98	1.86	1.98	46.25	48.00	40.50	45.25	35.125	47.33	24.95	45.50
Omitted		1			1	1		1	3	2	3
	Average of Spring Months 1839.										
Spring, 1839. Average	29.48	29.46	29.47	46.52	62.45	51.48	43.42	52.84	41.53	20.73	52.17
Maximum	30.04	30.03	29.92	69.50	81.50	72.50	65.50	74.00	67.48	48.21	72.00
Minimum	28.88	28.89	28.89	10.00	23.00	14.00	9.75	16.375	7.55	0.00	20.00
Range	1.16	1.14	1.03	59.50	61.50	58.50	55.75	57.625	59.93	48.21	52.00
Omitted		2	3		2	3		2	5	5	4

Total of 1839.												
Sky.				Winds.				Clouds.			Rain.	
	7 A.M Days	2 P.M Days	9 P.M Days		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Gauge. Inches.	
				N.	31	22	26	12	16	2		
				N. W.	97	89	87	70	85	24		
Ent. clr	103	59	150	N. E.	62	56	60	15	13	0		
				S.	26	30	30	7	8	3		
Ent.cld	99	85	101	S. W.	76	72	63	43	43	16		
				S. E.	30	39	45	13	18	4		
Prt. clr.	159	212	103	W.	20	29	24	67	83	21		
				E.	17	13	12	12	6	1		
	4	9	11		6	15	18	40	40	143	39.805	
Total of Winter Months 1838–39												
				N.	5	2	6	1	3	0		
				N. W.	26	28	30	29	28	9		
Ent. clr	14	9	36	N. E.	26	19	22	6	3	0		
				S.	2	3	2	2	1	0		
Ent.cld	38	40	38	S. W.	18	12	11	7	10	4		
				S. E.	10	15	14	2	1	1		
Prt. clr.	38	40	16	W.	3	8	4	11	17	2		
				E.	0	2	1	8	2	0		
		1				1		11	21	39	12.488	
Total of Spring Months 1839.												
				N.	6	6	7	4	6	0		
				N. W.	27	20	19	17	15	5		
Ent. clr	29	28	47	N. E.	11	13	10	1	2	0		
				S.	8	9	8	1	0	0		
Ent.cld	22	15	21	S. W.	21	16	18	9	6	4		
				S. E.	6	8	9	3	5	1		
Prt. clr.	41	47	21	W.	2	7	6	19	20	7		
				E.	7	3	3	1	0	0		
		2	3		4	10	12	14	11	26	10.211	

Meteorological Journal—Continued.

Average of Summer Months 1839. — *Total of Summer Months 1839.*

Summer, 1839.	Barometer. 7 A.M.	Barometer. 2 P.M.	Barometer. 9 P.M.	Thermometer. 7 A.M.	Thermometer. 2 P.M.	Thermometer. 9 P.M.	Thermometer. Reg'r.	Thermometer. Mean.	Hygr'm'tr, 2 P.M. Dew point.	Hygr'm'tr, 2 P.M. Diff. bet. dew pt. & therm.	Hygr'm'tr, 2 P.M. Wet bulb.	Sky.	Sky. 7 A.M. Days	Sky. 2 P.M. Days	Sky. 9 P.M. Days
Average	29.48	29.47	29.48	65.48	76.93	67.80	62.43	69.82	61.85	13.77	67.68				
Maximum	29.78	29.77	29.76	77.50	91.00	79.00	75.25	80.00	77.48	28.24	79.50	Ent. clr	23	3	25
Minimum	29.13	29.17	29.16	50.00	57.25	53.00	49.00	53.125	46.14	0.00	54.00	Ent.cld	21	16	20
Range	.65	.60	.60	27.50	33.75	26.00	26.25	26.875	31.34	28.24	25.50	Prt. clr.	45	68	41
Omitted		2			2			2	3	3	3		3	5	6

Winds.	Winds. 7 A.M. Days	Winds. 2 P.M. Days	Winds. 9 P.M. Days	Clouds. 7 A.M. Days	Clouds. 2 P.M. Days	Clouds. 9 P.M. Days	Rain. Rain Gauge. Inches.
N.	10	6	7	4	3	2	
N. W.	27	20	16	17	23	6	
N. E.	14	11	15	5	6	0	
S.	11	10	12	3	4	2	
S. W.	16	24	19	13	13	7	
S. E.	5	5	10	4	7	2	
W.	6	9	6	22	30	8	
E.	2	3	3	2	0	1	
	1	3	4	7	7	39	10.373

Average of Autumnal Months 1839. — *Total of Autumnal Months 1839.*

Autumn, 1839.	Barometer. 7 A.M.	Barometer. 2 P.M.	Barometer. 9 P.M.	Thermometer. 7 A.M.	Thermometer. 2 P.M.	Thermometer. 9 P.M.	Thermometer. Reg'r.	Thermometer. Mean.	Hygr'm'tr, 2 P.M. Dew point.	Hygr'm'tr, 2 P.M. Diff. bet. dew pt. & therm.	Hygr'm'tr, 2 P.M. Wet bulb.	Sky.	Sky. 7 A.M. Days	Sky. 2 P.M. Days	Sky. 9 P.M. Days
Average	29.59	29.57	29.58	46.51	62.04	51.89	44.60	53.20	47.09	14.27	54.29				
Maximum	30.12	30.13	30.16	76.00	86.00	75.50	74.00	80.00	75.14	28.70	76.50	Ent. clr	37	19	42
Minimum	28.96	28.93	28.92	14.50	25.00	19.00	14.00	19.50	5.38	0.00	21.00	Ent.cld	18	14	22
Range	1.16	1.20	1.14	61.50	61.00	56.50	60.00	60.50	69.76	28.70	55.50	Prt. clr.	35	57	25
Omitted	1	2	2	2	2	2		2	2	2	2		1	1	2

Winds.	Winds. 7 A.M. Days	Winds. 2 P.M. Days	Winds. 9 P.M. Days	Clouds. 7 A.M. Days	Clouds. 2 P.M. Days	Clouds. 9 P.M. Days	Rain. Rain Gauge. Inches.
N.	10	6	6	3	4	0	
N. W.	17	20	22	9	19	4	
N. E.	11	13	13	3	2	0	
S.	5	8	8	1	3	1	
S. W.	21	20	15	14	14	1	
S. E.	9	10	12	4	5	0	
W.	9	8	8	15	22	4	
E.	8	5	5	1	4	0	
	1	1	2	6	3	39	6.733

Notices of the weather, and meteorological observations, made at Nashville, Tennessee. By Prof. J. Hamilton.

TO THE COMMITTEE OF THE FRANKLIN INSTITUTE ON METEOROLOGY.

Meteorological Summary, April, 1840.

Mean temperature 62°.63—max. 88° on 25th—min. 35° on 2d day. Range 53°—mean height, 29.597 in., max. 29.86 on 13th—min. 29.32 on 17th. Range 54°. Spring remarkably forward. Apple blossoms seen on the 3d, and roses abundant on the 25th. The minimum temperature during the night of the 25th was only 74°, and the windows of dormitories were generally kept open. On the same day, however, in Rome, a deep snow fell, and we are told of a similar occurrence in 1505. A white frost was seen here on the 13th, and might have been on the 2d but for the clouds. The amount of rain during the month was 11.82 inches. There were 16 days, either wholly or partially rainy. Of 90 observations on direction of winds, 41 were from S. W., 21 from W. and from N. E., E. and S. E. 15, besides 13 under-currents. On the 26th, a thunder storm from 9 h. 15 m. to 10 h., A. M., with South wind, which changed to N. W. by W. at 11½ A. M. A severe storm this day in Maine.

May.

Mean temperature 66°.7—max. 86° on 31st—min. 42° on 12th. Range 44°. Max. of Bar. 29.82 on 12th—min. 28.98 on 3d. Range 84. This month, too, had 16 days of rain, and the amount that fell was 6.55 inches. On the 7th, 2.30 in., and on the 27th, 2.12 inches. E., S. E. and S. W. wind very prevalent. The 7th day, memorable for the Tornado at Natchez, was ushered in with a thunder storm, at 7, A. M. The thunder and rain were very heavy for about four hours. An intermission then ensued of two hours, when the storm was renewed, but with less violence, and continued until 11, P. M. The wind, during the day, was Easterly, until about 3, P. M., afterward S. E. The Thermometer varied from 64° to 67°, and the Barometer from 29.44 to 29.37. The minimum being at 3, P. M. is the same as given by Dr. Tooley of Natchez, near the time of the Tornado. It continued falling until 3, P. M. on the 8th, when it was at 29.06. Wind S. W. until 5, P. M., and Dew point 58°—the violent storms at this hour, in several places N. E. of Nashville, with hail as large as hens' eggs. No rain here. The 10th, 11th and 12th days cloudy and cold. A thunder storm on the 29th, at 10, P. M., while you had the Aurora Borealis.

June.

Mean temperature 76°.65—max. 94° on 27th—min. 52° on 8th. Range 42°. Mean of Bar. 29.566—max. 29.85 on 11th—min. 29.28 on 3d. Range 57. This also was a wet month, there being 10 days on which it rained. Whole amount of rain 5.72 inches. Of 90 observations at 9, A. M., Noon, and 3, P. M., 52 presented a clear sky—29 cloudy, and 9 rainy. Of a like number on winds, 39 were from the S. W.—21 from the W., and 21 from the N. E., E. and S. E. The second week alone gave fine weather.

During the morning of June 20th, cumuli abound, and at noon a thunder storm is formed in S. and S. W. At 2, P. M. detached clouds approach with vivid flashes of lightning and heavy thunder. At 6, P. M. a heavy storm from S. W. with much lightning and rain, but little thunder. Rain ceased at 11, P. M., but still cloudy and lightning at a distance.

Meteorological Observations, at the Summer Solstice of 1840, *made in conformity with the instructions of the South African Literary and Philosophical Institution, at the University of Nashville, Tennessee, in North Latitude,* 36° 09′ 33″, *West Long.* 86° 49′ 03″; *by* JAMES HAMILTON, *Prof. Math. and N. Philos.*

June 22, 1840.

	External Therm.	Attach'd Therm.	Barom.				
6 A. M.	73	83	29.49	c	*S. W.* / *N. E.*	0 / 1	same cumuli in North. 6 h. 20 m. gentle rain, 6 h. 30 m. thunder
7	73.5	82	29.52	R	*S. W.*	0	Storm heavy in S. and S. West. Rain heavy at 7 h. and continued so.
8	73.5	81.5	29.53	r	*S. W.* / *S. E.*	0	45 minutes then lighter until 8 h. 30 m.
9	77	82	29.55	c	*S. W.*	0	Still sprinkles.
10	78.5	82	29.56	r	*S. W.* / *S. E.*	0 / 1	Rain increases.
11	78.5	82	29.56	R	*S. W.* / *S.*	0 / 1	Heavy rain—11 h. 30 m. lighter.
12	79	81.5	29.54	c	*S. W.* / *S. E.*	0 / 0	Ceases 11 h. 35 m.—clouds break in N. W. [and W. Rain gauge 1.31 inches.
1 P. M.	81	81.5	29.535	c	*S. W.* / *S. E.*	0 / 1	
2	83.5	81.5	29.53	c	*S. W.* / *S. E.*	1 / 1	Clouds gather in S. W.
3	81	81.5	29.527	c	*S. W.* / *S. E.*	1 / 1	Dew point 69°—3 h. 15 m. shower in S.
4	82	82	29.53	c	*S. W.* / *S.*	1 / 1	3 h. 30 m. clouds thin in N. and strong S. W. wind.
5	80	82	29.54	c	*S. W.*	0	5 h. 25 m. cumuli in S.—sun shines fair.
6	79.5	81.5	29.54	$\frac{C}{2}$	*S. W.* by *W.*	1	A clear sky in West.
7	78	81.5	29.55	c	Do.	1	Sun sets clear.
8	77	81.5	29.57	$\frac{3}{8}$c	Do.	1	Broken clouds over North—bluish hue.
9	75	81	29.585	$\frac{C}{2}$	Do.	2	Thunder storm in N.—thunder audible.
10	76	81	29.60.	$\frac{C}{2}$	*S. W.*	1	Black clouds in horizon, W. and S. W. These clouds more elevated.
11	74	81	29.62	c	*S. W.*	0	same spread over the sky, 11h. 15 m. little rain.
12	75	80.5	29.61	c	*S. W.*	0	Clouds thinner. Light from rising moon. Dew point 69.5—12 h. 50 m. moon shines.
		JUNE 23.					
1 A. M.	75.5	80.5	29.60	c	*S. W.*	1	Clouds break in North.
2	74	80.5	29.60	c	*S. W.*	1	Sprinkles a little.
3	76	80	29.60	c	*S. W.*	0	Clouds heavy in N. W. moon visible.
4	75.5	79.8	29.62	c	*S. W.* / *W.*	0	
5	74.5	79.5	29.63	c	*W.* / *E.*	0	5 h. 35 m. a very light rain which continues till 6 h. 20 m.
6	76	79.5	29.675	r	*S. W.* / *S. E.*	1	
7	77.5	79.5	29.68	r	*S. W.*	1	6 h. 50 m. heavy clouds in S.
8	76.5	79.5	29.69	r	*S. W.*	1	Showers from 7 h. to 7 h. 30 m. Dew point [72.
9	79	80	29.70	r	*S. W.*	1	Between 9 h. and 10 h. rain heavy.

10	82	80.5	29.70	c	*S. W.* 1	10 h. 20 m. rain increases.
11	82.5	82	29.69	r	*S. W.* 2	Wind continued S. W. until June 28th, P. M.
12	79.5	79	29 69	r	*S. W.* 1	with occasional showers, making 4.24

inches of rain in all—weather settled with W. wind—min. of Bar. during these rains. 29.44 on 26th. Dew point at 3, P. M., June 23, 69.5—24th, 73—25th, 73—26th, 75—27th, 74—28th ,70, and 29th, 70.—The above observations were made in the same place and with the same instruments as in former cases.

Franklin Institute.

Quarterly Meeting.

The Sixty-sixth Quarterly Meeting of the Institute was held at their Hall, July 16, 1840.

Robert M. Patterson, M. D. was appointed Chairman, and
John H. Towne, Esq. Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

Donations to the Institute were presented from the following gentlemen:

Of Books and Engravings—from The Royal Geographical Society; The Society of Arts; and William Vaughan, Esq., London; Hon. Daniel Sturgis, Washington city, D. C.; Dr. D. Haughton, Detroit, Michigan; W. L. Atlee, M. D., Lancaster, Pennsylvania; Col. S. H. Long, Marietta, Georgia; Prof. G. Troost, Tennessee; George Merrick, Esq., New Orleans, Louisiana; Wm. Jenks, Esq., Springfield, Mass.; and Messrs. Thomas M. Way; B. M. Hinchman; Joseph S. Silver; J. J. Barclay; G. Emerson, M. D.; James Ronaldson; Isaac Hays, M. D.; C. Ellett, Jr.; J. C. Montgomery; Sol. W. Roberts; John C. Cresson; Andrew Young; Edward Miller; L. Vanuxum; A. L. Elwyn, M. D.; Frederick Fraley; Richard Penn Smith; W. H. Wilson; Reubens Peale; William Strickland; Thomas U. Walter; R. C. Taylor; Alexander Dallas Bache, and Robert Jones, of Philadelphia.

Of Models—from Edward Bancroft, of Providence, R. Island; William Russell, of the city of New York; William Jenks, of Springfield, Massachusetts, and L. E. Denison, of Sayville, Connecticut.

Of Minerals—from Mr. Joseph Harrison, Jr., Philadelphia.

Of Galvanic Medels—from Messrs. Isaiah Lukens, Joseph Saxton, and Charles Sheble, of Philadelphia.

The Actuary laid on the table the periodicals received in exchange for the Journal of the Institute since the last meeting.

The quarterly report from the Board of Managers was read and accepted and referred for publication.

The Treasurer submitted his quarterly statement of the Funds of the Institute, which was received and accepted.

George W. Smith, Esq. called the attention of the Institute to that part of the report from the Board of Managers, relative to the loss sustained by the Institute in the decease of William H. Keating, Esq., and after some remarks, moved that a committee be appointed to prepare a biographical notice of the deceased, which was seconded by Prof. John C. Cresson.

Whereupon, Messrs. Samuel V. Merrick, John C. Cresson, Alexander Dallas Bache, and Robert M. Patterson, were appointed the committee.

Robert M. Patterson, *Chairman.*

John H. Towne, *Rec. Sec. Pro. Tem.*

Sixty-sixth Quarterly Report of the Board of Managers.

The Board of Managers respectfully submit to the Society their sixty-sixth quarterly report.

The three months, just elapsed, embrace the period of the year in which the more active operations of the Institute are in great measure suspended, and which does not, therefore, afford materials for a very extended or interesting report. The Committee on Science and the Arts, and the monthly conversation meetings, which constitute the most prominent objects of interest this season, have been sustained with unabated activity, and afford abundant evidence of the good policy of their establishment and continued support. The latter will be suspended, according to the custom of former years, for the months of July and August, and will be resumed in the month of September, it is hoped, with renewed interest and unceasing benefit.

The Committee on Instruction anticipate the ability to extend their important department, by the addition of two complete courses of volunteer lectures; one on Geology, and the other on Architecture and the Fine Arts. These, with the regular courses on Chemistry, Natural Philosophy, and Technology, will occupy five evenings in the week, and it is expected that the remaining evening will be occasionally filled by lectures on various interesting subjects. The Committee on Premiums and Exhibitions have completed their preliminary arrangements for the exhibition of American Manufactures to be held this year, opening on the sixth day and continuing to the seventeenth day of October. The address of the Committee has been prepared for distribution, and is recommended to the notice of members and to their active exertions for giving it extensive circulation.

The Journal of the Institute, and its Cabinets of Models, of Minerals and of the Arts, receive the usual attention of the Committees to whose care they are intrusted, and are gradually acquiring greater value and usefulness.

The Board has received, with feelings of deep sorrow, intelligence of the decease of their late fellow member, William H. Keating, who died in London on the 17th day of May, ulto.—Mr. Keating was one of the original projectors of the Institute; he has served as one of its managers from its foundation to the period of his lamented decease, and has ever proved to be the zealous friend and efficient promoter of all its useful objects. To the members of the Institute with whom he has been so long associated, his memory is endeared by the recollection of his inflexible rectitude of moral and religious principle; tempered in his intercourse with his fellow men, by a suavity of manner resulting from the genuine benevolence of his heart. It is much to be desired that the benign influence of his example may be perpetuated to the Institute by a permanent record of his services and character.

During the past quarter, Messrs. Isaac S. Ashton, H. I. Biddle, and W. J. Birkey, have become life members.

The Treasurer's report on the funds of the Institute is herewith submitted.

John C. Cresson, *Chairman.*

William Hamilton, Actuary.

Minutes of Meeting of the Board of Managers.

A special meeting of the Board of Managers was held at the Hall of the Institute, June 27, 1840.

Professor John C. Cresson, *Chairman.*

The Chairman stated that the meeting had been convened to adopt such measures as might be deemed proper, in consequence of the death of one of the members of the Board.

Dr. Hays announced with some brief remarks, that the Board had just sustained a severe loss in the death of William H. Keating, Esq., who died in London on the 17th day of May, ulto.

Professor Alexander Dallas Bache then offered the following resolutions, which were seconded by Dr. Hays, and unanimously adopted, viz:

Resolved, That the Board of Managers of the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, have learned with the deepest regret, the decease of their late fellow member, William H. Keating, Esq., whose zeal and activity during a period of service, beginning with the establishment of the Board, commanded their respect, while his amiability and consideration for others, endeared him to them in an especial manner.

Resolved, That as one of the founders of the Franklin Institute, its first Professor of Chemistry applied to the arts, and as a most efficient member of its Board of Managers and Committees from the first organization of the Institute, with only a brief interval, during his absence from the country, until the period of his lamented decease, Mr. Keating is justly entitled to the grateful thanks of those upon whom the benefits of the institution have been conferred.

Resolved, That the Chairman of the Board of Managers, be requested to communicate the decease of W. H. Keating, Esq. to the Franklin Institute, in a manner expressive of the high regard entertained for his services by his fellow members of the Board, and their deep feeling for his loss.

Resolved, That a committee be appointed to offer, on behalf of the Board of Managers of the Franklin Institute, to the family of Mr. Keating, sincere condolence in their affliction, and to express the sense of the loss which has been sustained, not only by his friends, but by the community in which Mr. Keating resided, and to communicate to them the foregoing resolutions.

On motion, Isaac Hays, M. D., Alexander Dallas Bache, Samuel V. Merrick. John Struthers, and Frederick Fraley, were appointed a committee to present the above resolutions to the family of Mr. Keating.

John C. Cresson, Chairman.

William Hamilton, Actuary.

Conversation Meeting.

The 10th conversation meeting held at the Hall of the Institute on Thursday evening, June 27th, was numerously attended and highly interesting.

Professor James C. Booth briefly explained the process of manufacturing and painting porcelain; and called attention to the importance of this much neglected branch of the arts.

Dr. Hare, after succinctly describing the progressive improvements in voltaic or galvanic batteries, explained a very powerful apparatus (which

was exhibited,) made upon his improved plan, and by his directions, for Professor Silliman. Mr. Joaquim Bishop, Dr. Hare's former assistant, was the manufacturer.

Among other interesting articles we noticed some specimens of cast and wrought iron made with anthracite coal. The cast iron from the Roaring Creek Furnace, and the bar iron from the Catawissa Forge: some leaden pipe, remarkable for the beautiful polish of its surface and its superior quality; it was made by a new process at the establishment of Messrs. Tatham & Brothers.

Mr. John A. Stewart exhibited a model of a house heated upon a novel plan; and Mr. Scott, a refrigerator, apparently well adapted to the purpose for which it was designed.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on a Plan for constructing Railroads, invented by Mr. James Herron, of Maryland, Civil Engineer.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Plan for constructing Railroads, invented by Mr. James Herron, of Maryland, Report:—

That they have examined with much care and interest the drawings and model submitted by the inventor, and have had the advantage of this gentleman's personal explanations.

It appears to us, that Mr. Herron has fully understood and appreciated the evils inseparably connected with those plans of railway superstructure, so much in use here, as well as in Europe, in which the rails are supported upon isolated blocks of stone, or sleepers of timber. In a climate like that of our northern and middle states, it is out of the question for us to encounter the expenditure which would be necessary in order to obviate the influence of frost. Even our best constructed roads are upheaved by its power, and where the supports of the rails are in the least degree unequal in their character, either in consequence of different dimensions, different depths of foundation, or different capacities in the sub-soil for imbibing water, the result is a succession of irregular elevations, depressions and lateral displacements, which are destructive alike to rails, cars and engines, and productive of a jarring and lurching motion extremely disagreeable to passengers, and by no means free from danger. When the rails are supported on cross ties of timber resting upon mud-sills of plank, (which is also a common form of superstructure in America,) a much better form of road is obtained, though still far from perfect. The irregularities caused by unequal settlements are less numerous and less sudden, but there is still nothing to prevent one mud-sill from rising above another from the action of frost, where the ends of two come in contact. The sleepers may be, and no doubt are, often elevated entirely from the sills, and are also laterally displaced, giving a slightly serpentine form to the rails, which enhances the flanch friction materially. But even if all these evils be avoided, there is still a radical defect common both to this and the former plan, which is thus adverted to in a pamphlet written on this subject by John Reynolds, Esq. in 1837.—"The chief obstacle to durability which pertains to the plan of supports at intervals, whether they be blocks or sleepers, is the alternation of *flexible spaces* and *rigid points*, which (even if the supports

maintain an exact level,) produces in carriages moving rapidly over them, a series of concussions, as the wheels successively impinge on the rigid or supported parts of the rails. Also, however small may be the deflexion of the rail between its points of support, those points become fulcra, on which it acts as a lever, to raise or shake the supports next beyond them. When the supports have assumed irregular heights, (which is the usual case) not only are the above evils greatly aggravated, but the rail acts on every depressed support as a spring-beam, tending to jerk it up, or loosen its fastenings."

In addition to the above, we may add, what is perhaps sufficiently obvious, viz. that the weight of the iron rails may be diminished proportionably with the distance between the points of support; and consequently, the minimum quantity of iron will be required, when the bearings are continuous.

The difficulties above alluded to are not merely theoretical. Every engineer who has had charge of the repairs of a finished railroad will vouch for their practical existence, although much discrepancy of opinion exists concerning the most appropriate remedies.

Mr. Herron's object appears to have been, to devise a plan in which all the parts forming the structure shall be fully and adequately supported; while at the same time they shall be so connected together, that no portion will be liable to independent displacement, either laterally or vertically.— He has proposed several modifications, all of which he thinks may be applicable in particular situations. Those which the committee consider decidedly preferable, both from simplicity and efficiency, are designated on his drawings, as Nos. 1 and 4. In both of these, he uses a continuous line of timbers supporting each rail throughout, which are joined at the points of contact by a new scarph, peculiarly well adapted to the purpose, and strengthened materially by the manner in which the iron rails (which may be either ⊥ or bridge form,) are attached to the longitudinal timbers. The whole is supported and stiffened by a system of diagonal cross planks, which have a triple use, as they afford a considerable breadth of bearing, act both as ties and braces to prevent lateral displacement, and being loaded by ballast will counteract any tendency which the bearers might otherwise have to become warped by changes of moisture and temperature. Sand or gravel is to be rammed under the longitudinal timbers, so as to give them a firm and equable foundation throughout, and the whole roadway when finished, is to be filled with the same materials, as high as the base of the iron rails.

The wrought iron chairs proposed by Mr. Herron for the joints of the rails, are of a form new to this Committee, and if they can be manufactured by machinery, (which, if good iron be used, appears probable,) will possess advantages over most of those now employed, as they will clasp the rails, without the intervention of wedges or screw-bolts, with sufficient firmness to prevent any deviation at the joints, yet not so closely as to hinder them from expanding longitudinally by changes in temperature. The rails are to be fastened permanently at their centres to the longitudinal timbers, so as to cause the expansion to take place equally in both directions, thus reducing the spaces necessary between the ends of the rails to a minimum.

The Committee do not think it necessary to enter into a minute description of the proposed plans, which could not be made fully intelligible without accurate drawings; nor do they wish to be understood as fully approving of all the parts, some of which appear to be attended with practical difficul-

ties, though not of an insurmountable character. The principles aimed at in the design, have their fullest sanction; and they would gladly witness an experiment carried out upon a working scale, with timber kyanised, or otherwise prepared so as to be secure from decay.

Of course there are many points of importance embodied in the general scheme, which have been previously suggested by other engineers, who have at various times adopted similar contrivances. Other details are certainly original, and the whole combination evinces a degree of judgment and ingenuity which we hope will not pass unrewarded.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

July 9, 1840.

Report on the Boring Mill, constructed by Messrs. Merrick & Towne.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the Boring Mill constructed by Messrs. Merrick & Towne, of Southwark, Philadelphia, Penn., REPORT :—

That the visit to the establishment of Messrs. Merrick & Towne, known as Southwark Foundry, for the purpose of examining their Boring Mill, afforded an opportunity to learn many interesting particulars, with a brief statement of which it may be useful to preface their description of the machine under consideration. Southwark Foundry is situated on the Prime Street Railroad, between Fourth and Fifth streets. The buildings occupy three sides of a plot 200 by 370 feet, and consist of a machine shop 160 by 40 feet, three stories high; a smith shop of the same ground area, one story high; a Foundry 180 by 50 feet, and a boiler-shop 145 by 45 feet. The ground floor of the machine shop, with the exception of a portion at the front end, used as an office, is occupied by the Boring and Planing machines and heavy slide Lathes, one of which will turn a piece of work 4 feet diameter and 31 feet long. Upon the second floor are the lighter lathes, vice-benches, drilling machines, and small planing machine. In this room, at the time of the visit of the Committee, were to be seen various specimens of finished work, which fully sustain the good reputation of Philadelphia in this branch of manufacture. The third floor is used as the pattern-makers' shop and pattern loft. Some of the patterns in course of construction for the frame of the engine of the New Jersey Frigate hereafter referred to, would seem from their immense size to be designed to form a large and highly ornamented building rather than parts of a movable machine. At the southern end of the machine shop is a steam engine of 15 H. P., which drives the machinery of this building and the adjoining smithshop. The latter contains 18 forges, the blast for which is derived from a fan driven by the engine. The heavier forgings are executed under a small vertical trip-hammer, which is capable of faggoting a bar 6 inches square. This must prove of great advantage both as a labour-saving machine and as a means of obtaining greater perfection of the weldings. Some samples of forgings were shewn which evince a high degree of skill in this important art.

In the Foundry much was seen worthy of approval. The machinery and apparatus do not appear to be more extensive or various than are seen in many other establishments, but the magnitude of the castings is much

superior, and their perfect finish and soundness fully equal to any which have come under notice of the Committee. The permanent apparatus comprises three 8 ton cranes, two ovens for drying moulds, one 8 by 24 feet, the other 12 by 32, and two cupola furnaces, respectively 39 and 42 inches diameter, with a fan blast driven by an 8 horse engine. These cupolas are capable of melting iron for a casting of 16 tons. The heaviest piece of casting which has yet been made is a bed-plate for the U. S. Frigate's engines which these gentlemen are constructing. For this casting, which weighs about 14 tons, 36,000 lbs. of metal were melted in 2 hours and 40 minutes; the metal being drawn off into shanks as fast as it came down.

The plate has just been cleared from the mould, and displays in its broad proportions, a most beautiful specimen of casting, presenting a surface of more than 200 square feet without blemish.

The steam cylinders for the same engines, weighing 8 tons net each, were melted by the larger cupola above, in about the same time. The most rapid melting in this cupola was 9000 lbs. in one hour.

The boiler shop is enlivened with the din of hammers employed in making the boilers for the Frigate's engines, four in number, made of copper 14 feet 6 inches long, 14 feet wide, and 12 feet high, with double return flues, weighing, when finished, 200,000 lbs.

The engines for the U. S. Frigate, to which allusion has been made, are now in a state of considerable forwardness, and constitute an object of much interest to any one desiring the success of American manufactures. They are of the general form known as English Marine Engines—the cylinders being vertical, with two lever beams, one on each side, working on pedestals rising from the bed-plate, and connected with the cross-head over the cylinder and with the connecting rod, by side links.

The principal dimensions are, diameter of cylinders 75 inches, length of stroke 7 feet, bed-plate 29 feet 2 inches, by 7 feet 4 inches, with channels cast on—Main shaft, wrought iron, 17 inches diameter, 25 feet 8 inches long—Paddle wheels entirely of iron, 29 feet 8 inches diameter and 10 feet bucket. The work upon them was commenced in January, 1840, and is expected to be completed in the spring of 1841.

The large Boring Mill which was the special object of the visit to Southwark Foundry, appears to be of entirely novel construction, and especially adapted to work of great magnitude, such as is found in the large engines now building. The boring shaft is vertical, and the cylinder to be bored stands upright on the bed or face-plate, and revolves around the bar—the latter being stationary. The face-plate is keyed on to the upper end of a vertical shaft 8 feet long, stepped into a brass bearing, and confined by a collar directly beneath the plate; the collar being secured by heavy timber-framing, bolted to a massive brick foundation. A pinion geared to the main shaft of the steam engine gives motion to the face-plate by working into teeth on its periphery. The boring-bar is 14 inches in diameter; it is inserted into a recess in the centre of the face-plate, and secured at the upper end by a cast iron plate on the second floor of the building. Directly over this on the third floor, is a hoisting machine for raising the bar and placing work on the mill.

The boring-head, on which the cutters are fixed, is keyed to a movable sleeve which traverses up and down the boring-bar upon two feathers, working in grooves on its opposite sides. The traversing motion on the sleeve and head is derived from a long screw which passes freely down the hollow axis of the boring-bar: and the head of the screw is a cross-head, con-

nected by two stirrups to the sleeve. The nut of the screw swivels on the head of the boring-bar, and receives motion from a train of gearing and tangent screw: the rate of traverse motion is varied by changing the gearing of the nut.

The cylinder to be bored is screwed at the lower end to the face-plate, and at the upper end to a cast iron cross which works around a collet, fitted to the boring-bar, with slots for the passage of the stirrups which sustain the boring head: this collet is movable up and down the bar to suit the length of the cylinder.

By this arrangement the cylinder is firmly fixed at both ends to the bar which carries the cutters, and cannot possibly get out of centre, nor be subject to any inaccuracy except what may arise from the springing of the boring-bar between the bearings at the ends of the cylinder, which is not likely to be an appreciable quantity in a cast iron bar 14 inches diameter. By substituting a cast iron rest in place of the boring-bar, for which provision is made, the mill is converted into a horizontal face-plate lathe, capable of turning a flanch $11\frac{1}{2}$ feet in diameter. It will bore a cylinder of 96 inches diameter and 14 feet length. The work appears to be executed with much greater rapidity than is usual upon the horizontal mill—the cylinders for the Frigate, one of which was in the mill at the time of examination, having been completed in eight days each.

This machine must be esteemed of great importance in the construction of large machinery, both as a means of expediting the work and of insuring greater accuracy of finish. It has the advantage in common with other vertical boring mills, of avoiding the imperfection of form arising from boring a large cylinder while lying on its side, such a cylinder being oval in its section when taken out of the mill and placed upright.

Possessing therefore, as it does in the opinion of the Committee, both the requisites of novelty and usefulness, it is deemed a proper subject for the Scott's Legacy premium, an award of which is accordingly recommended.

By order of the Committee.

William Hamilton, Actuary.

July 17, 1840.

Mechanics' Register.

An Act in addition to the act to promote the progress of Science and Useful Arts.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person who may be in possession of, or in any way interested in, any patent for an invention, discovery, or improvement, issued prior to the fifteenth day of December, in the year of our Lord one thousand eight hundred and thirty-six, or in an assignment of any patent, or interest therein, executed and recorded prior to the said fifteenth day of December, may without charge, on presentation or transmission thereof to the Commissioner of Patents, have the same recorded anew in the Patent Office, together with the descriptions, specifications of claim, and drawings annexed or belonging to the same; and it shall be the duty of the Commissioner to cause the same, or any authenticated

copy of the original record, specification, or drawing which he may obtain, to be transcribed and copied into books of record to be kept for that purpose; and wherever a drawing was not originally annexed to the patent and referred to in the specification, any drawing produced as a delineation of the invention, being verified by oath in such manner as the Commissioner shall require, may be transmitted and placed on file, or copied as aforesaid, together with the certificate of the oath; or such drawings may be made in the office, under the direction of the Commissioner, in conformity with the specification. And it shall be the duty of the Commissioner to take such measures as may be advised and determined by the Board of Commissioners provided for in the fourth section of this act, to obtain the patents, specifications, and copies aforesaid, for the purpose of being so transcribed and recorded. And it shall be the duty of each of the several clerks of the judicial courts of the United States, to transmit as soon as may be, to the Commissioner of the Patent Office, a statement of all the authenticated copies of patents, descriptions, specifiations, and drawings of inventions and discoveries made and executed prior to the aforesaid fifteenth day of December, which may be found on the files of his office; and also to make out and transmit to said Commissioner, for record as aforesaid, a certified copy of every such patent, description, specifiation, or drawing, which shall be specially required by said Commissioner.

SECTION 2. *And be it further enacted,* That copies of such record and drawings, certified by the commissioner, or, in his absence, by the chief clerk, shall be prima facie evidence of the particulars of the invention and of the patent granted therefor, in any judicial court of the United States, in all cases where copies of the original record or specification and drawings would be evidence, without proof of the loss of such originals; and no patent issued prior to the aforesaid fifteenth day of December shall, after the first day of June next, be received in evidence in any of the said courts in behalf of the patentee or other person who shall be in possession of the same, unless it shall have been so recorded anew, and a drawing of the invention, if separate from the patent, verified as aforesaid, deposited in the Patent Office; nor shall any written assignment of any such patent, executed and recorded prior to the said fifteenth day of December, be received in evidence in any of the said courts in behalf of the assignee or other person in possession thereof, until it shall have been so recorded anew.

SECTION 3. *And be it further enacted,* That whenever it shall appear to the Commissioner that any patent was destroyed by the burning of the Patent Office building on the aforesaid fifteenth day of December, or was otherwise lost prior thereto, it shall be his duty, on application therefor by the patentee or other person interested therein, to issue a new patent for the same invention or discovery, bearing the date of the original patent, with his certificate thereon, that it was made and issued pursuant to the provisions of the third section of this act, and shall enter the same of record: *Provided, however,* That before such patent shall be issued, the applicant therefor shall deposit in the Patent Office a duplicate, as near as may be, of the original model, drawings, and descriptions, with specification of the invention or discovery, verified by oath, as shall be required by the Commissioner; and such patent and copies of such drawings and descriptions, duly certified, shall be admissible as evidence in any judicial court of the United States, and shall protect the rights of the patentee, his administrators, heirs, and assigns, to the extent only in which they would have been protected by the original patent and specification.

Section 4. *And be it further enacted*, That it shall be the duty of the Commissioner to procure a duplicate of such of the models destroyed by fire on the aforesaid fifteenth day of December, as were most valuable and interesting, and whose preservation would be important to the public; and such as would be necessary to facilitate the just discharge of the duties imposed by law on the Commissioner in issuing patents, and to protect the rights of the public and patentees in patented inventions and improvements: *Provided*, That a duplicate of such models may be obtained at a reasonable expense: *And provided, also*, That the whole amount of expenditure for this purpose shall not exceed the sum of one hundred thousand dollars. And there shall be a temporary board of commissioners, to be composed of the Commissioner of the Patent Office and two other persons to be appointed by the President, whose duty it shall be to consider and determine upon the best and most judicious mode of obtaining models of suitable construction; and, also, to consider and determine what models may be procured in pursuance of, and in accordance with, the provisions and limitations in this section contained. And said commissioners may make and establish all such regulations, terms, and conditions, not inconsistent with law, as in their opinion may be proper and necessary to carry the provisions of this section into effect, according to its true intent.

Section 5. *And be it further enacted*, That, whenever a patent shall be returned for correction and re-issue, under the thirteenth section of the act to which this is additional, and the patentee shall desire several patents to be issued for distinct and separate parts of the thing patented, he shall first pay, in manner and in addition to the sum provided by that act, the sum of thirty dollars for each additional patent to be issued: *Provided, however*, That no patent made prior to the aforesaid fifteenth day of December, shall be corrected and re-issued until a duplicate of the model and drawing of the thing, as originally invented, verified by oath as shall be required by the Commissioner, shall be deposited in the Patent Office. Nor shall any addition of an improvement be made to any patent heretofore granted, nor any new patent be issued for an improvement made in any machine, manufacture, or process, to the original inventor, assignee, or possessor, of a patent therefor, nor any disclaimer be admitted to record, until a duplicate model and drawing of the thing originally invented, verified as aforesaid, shall have been deposited in the Patent Office, if the commissioner shall require the same; nor shall any patent be granted for an invention, improvement, or discovery, the model or drawing of which shall have been lost, until another model and drawing, if required by the Commissioner, shall, in like manner, be deposited in the Patent Office. And in all such cases, as well as in those which may arise under the third section of this act, the question of compensation for such models and drawings, shall be subject to the judgment and decision of the commissioners provided for in the fourth section, under the same limitations and restrictions as are therein prescribed.

Section 6. *And be it further enacted*, That any patent hereafter to be issued, may be made and issued to the assignee or assignees of the inventor or discoverer, the assignment thereof being first entered of record, and the application therefor being duly made, and the specification duly sworn to by the inventor. And in all cases hereafter, the applicant for a patent shall be held to furnish duplicate drawings, whenever the case admits of drawings, one of which to be deposited in the office, and the other to be annexed to the patent, and considered a part of the specification.

SECTION 7. *And be it further enacted*, That whenever any patentee shall have, through inadvertence, accident, or mistake, made his specification of claim too broad, claiming more than that of which he was the original or first inventor, some material and substantial part of the thing patented being truly and justly his own, any such patentee, his administrators, executors, and assigns, whether of the whole or of a sectional interest therein, may make disclaimer of such parts of the thing patented as the disclaimant shall not claim to hold by virtue of the patent or assignment, stating therein the extent of his interest in such patent; which disclaimer shall be in writing, attested by one or more witnesses, and recorded in the Patent Office, on payment by the person disclaiming, in manner as other patent duties are required by law to be paid, of the sum of ten dollars. And such disclaimer shall thereafter be taken and considered as part of the original specification, to the extent of the interest which shall be possessed in the patent or right secured thereby, by the disclaimant, and by those claiming by or under him subsequent to the record thereof. But no such disclaimer shall affect any action pending at the time of its being filed, except so far as may relate to the question of unreasonable neglect or delay in filing the same.

SECTION 8. *And be it further enacted*, That whenever application shall be made to the Commissioner for any addition of a newly discovered improvement, to be made to an existing patent, or whenever a patent shall be returned for correction and re-issue, the specification of claim annexed to every such patent shall be subject to revision and restriction, in the same manner as are original applications for patents; the Commissioner shall not add any such improvement to the patent in the one case, nor grant the re-issue in the other case, until the applicant shall have entered a disclaimer, or altered his specification of claim in accordance with the decision of the Commissioner; and in all such cases, the applicant, if dissatisfied with such decision, shall have the same remedy, and be entitled to the benefit of the same privileges and proceedings, as are provided by law in the case of original applications for patents.

SECTION 9. *And be it further enacted*, (any thing in the fifteenth section of the act to which this is additional to the contrary notwithstanding,) That whenever, by mistake, accident, or inadvertence, and without any wilful default or intent to defraud or mislead the public, any patentee shall have in his specification claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was not the first and original inventor, and shall have no legal or just right to claim the same, in every such case the patent shall be deemed good and valid for so much of the invention or discovery as shall be truly and bona fide his own: *Provided*, It shall be a material and substantial part of the thing patented, and be definitely distinguishable from the other parts so claimed without right as aforesaid. And every such patentee, his executors, administrators, and assigns, whether of a whole or sectional interest therein, shall be entitled to maintain a suit at law or in equity on such patent for any infringement of such part of the invention or discovery as shall be bona fide his own as aforesaid, notwithstanding the specification may embrace more than he shall have any legal right to claim. But in every such case in which a judgment or verdict shall be rendered for the plaintiff, he shall not be entitled to recover costs against the defendant, unless he shall have entered at the Patent Office, prior to the commencement of the suit, a disclaimer of all that part of the thing patented which was so claimed without right:

Provided, however, That no person bringing any such suit shall be entitled to the benefits of the provisions contained in this section, who shall have unreasonably neglected or delayed to enter at the Patent Office a disclaimer as aforesaid.

SECTION 10. *And be it further enacted,* That the Commissioner is hereby authorized and empowered to appoint agents in not exceeding twenty of the principal cities or towns in the United States, as may best accommodate the different sections of the country, for the purpose of receiving and forwarding to the Patent Office all such models, specimens of ingredients and manufactures, as shall be intended to be patented or deposited therein, the transportation of the same to be chargeable to the patent fund.

SECTION 11. *And be it further enacted,* That instead of one examining clerk, as provided by the second section of the act to which this is additional, there shall be appointed in manner therein provided, two examining clerks, each to receive an annual salary of fifteen hundred dollars; and, also, an additional copying clerk, at an annual salary of eight hundred dollars. And the Commissioner is also authorized to employ, from time to time, as many temporary clerks as may be necessary to execute the copying and draughting required by the first section of this act, and to examine and compare the records with the originals, who shall receive not exceeding seven cents for every page of one hundred words, and for drawings and comparison of records with originals, such reasonable compensation as shall be agreed upon or prescribed by the Commissioner.

SECTION 12. *And be it further enacted.* That whenever the application of any foreigner for a patent shall be rejected and withdrawn for want of novelty in the invention, pursuant to the seventh section of the act to which this is additional, the certificate thereof of the Commissioner shall be a sufficient warrant to the Treasurer to pay back to such applicant two-thirds of the duty he shall have paid into the Treasury on account of such application.

SECTION 13. *And be it further enacted,* That in all cases in which an oath is required by this act, or by the act to which this is additional, if the person of whom it is required shall be conscientiously scrupulous of taking an oath, affirmation may be substituted therefor.

SECTION 14. *And be it further enacted,* That all moneys paid into the Treasury of the United States for patents and for fees for copies furnished by the Superintendent of the Patent Office prior to the passage of the act to which this is additional, shall be carried to the credit of the patent fund created by said act; and the moneys constituting said fund shall be, and the same are hereby, appropriated for the payment of the salaries of the officers and clerks provided by said act; and all other expenses of the Patent Office, including all the expenditures provided for by this act; and, also, for such other purposes as are or may be hereafter specially provided for by law. And the Commissioner is hereby authorized to draw upon said fund, from time to time, for such sums as shall be necessary to carry into effect the provisions of this act, governed, however, by the several limitations herein contained. And it shall be his duty to lay before Congress, in the month of January, annually, a detailed statement of the expenditures and payments by him made from said fund. And it shall also be his duty to lay before Congress, in the month of January, annually, a list of all patents which shall have been granted during the preceding year, designating, under proper heads, the subjects of such patents, and furnishing an al-

phabetical list of the patentees, with their places of residence; and he shall also furnish a list of all patents which shall have become public property during the same period; together with such other information of the state and condition of the Patent Office as may be useful to Congress or to the public.

Approved, March 3d, 1837.

A Bill in addition to "An act to promote the progress of the Useful Arts."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there shall be appointed, in manner provided in the second section of the act to which this is additional, two assistant examiners, each to receive an annual salary of twelve hundred and fifty dollars.

SECTION 2. *And be it further enacted,* That the Commissioner be authorized to employ temporary clerks to do any necessary transcribing, whenever the current business of the office requires it: *Provided, however,* That, instead of salary, a compensation shall be allowed, at a rate not greater than is charged for copies now furnished by the office.

SECTION 3. *And be it further enacted,* That the Commissioner is hereby authorized to publish a classified and alphabetical list of all patents granted by the Patent Office previous to said publication, and retain one hundred copies for the Patent Office, and nine hundred copies be deposited in the library of Congress, for such distribution as may be hereafter directed; and that one thousand dollars, if necessary, be appropriated, out of the patent fund, to defray the expense of the same.

SECTION 4. *And be it further enacted,* That the sum of three thousand six hundred and fifty-nine dollars and twenty-two cents be, and is hereby appropriated from the patent fund, to pay for the use and occupation of rooms in the City Hall by the Patent Office.

SECTION 5. *And be it further enacted,* That the sum of one thousand dollars be appropriated from the patent fund, to be expended under the direction of the Commissioner, for the purchase of necessary books for the library of the Patent Office.

SECTION 6. *And be it further enacted,* That no person shall be debarred from receiving a patent for any invention or discovery, as provided in the act approved on the fourth day of July, one thousand eight hundred and thirty-six, to which this is additional, by reason of the same having been patented in a foreign country more than six months prior to his application: *Provided,* that the same shall not have been introduced into public and common use, in the United States prior to the application for such patent: *And provided, also,* that in all cases every such patent shall be limited to the term of fourteen years from the date or publication of such foreign letters patent.

SECTION 7. *And be it further enacted,* That every person or corporation who has, or shall have, purchased or constructed any newly invented machine, manufacture, or composition of matter, prior to the application by the inventor or discoverer for a patent, shall be held to possess the right to use, and vend to others to be used, the specific machine, manufacture, or composition of matter so made or purchased, without liability therefor to the inventor, or any other person interested in such invention; and no patent shall be held to be invalid by reason of such purchase, sale, or use

prior to the application for a patent as aforesaid, except on proof of abandonment of such invention to the public, or that such purchase, sale or prior use, has been for more than two years prior to such application for a patent.

SECTION 8. *And be it further enacted*, That so much of the eleventh section of the above recited act as requires the payment of three dollars to the Commissioner of Patents for recording any assignment, grant or conveyance of the whole or any part of the interest or right under any patent, be, and the same is hereby repealed; and all such assignments, grants, and conveyances shall, in future, be recorded without any charge whatever.

SECTION 9. *And be it further enacted*, That a sum of money, not exceeding one thousand dollars, be, and the same is hereby, appropriated, out of the patent fund, to be expended by the Commissioner of Patents in the collection of agricultural statistics, and for other agricultural purposes; for which the said Commissioner shall account in his next annual report.

SECTION 10. *And be it further enacted*, That the provisions of the sixteenth section of the before recited act shall extend to all cases where patents are refused for any reason whatever, either by the Commissioner of Patents or by the Chief Justice of the District of Columbia, upon appeals from the decision of said Commissioner, as well as where the same shall have been refused on account of, or by reason of, interference with a previously existing patent; and in all cases where there is no opposing party, a copy of the bill shall be served upon the Commissioner of Patents, when the whole of the expenses of the proceeding shall be paid by the applicant, whether the final decision shall be in his favour or otherwise.

SECTION 11. *And be it further enacted*, That in cases where an appeal is now allowed by law from the decision of the Commissioner of Patents to a board of examiners provided for in the seventh section of the act to which this is additional, the party, instead thereof, shall have a right to appeal to the Chief Justice of the district court of the United States for the District of Columbia, by giving notice thereof to the Commissioner, and filing in the Patent Office, within such time as the Commissioner shall appoint, his reasons of appeal, specifically set forth in writing, and also paying into the Patent Office, to the credit of the patent fund, the sum of twenty-five dollars. And it shall be the duty of said Chief Justice, on petition, to hear and determine all such appeals, and to revise such decisions in a summary way, on the evidence produced before the Commissioner, at such early and convenient time as he may appoint, first notifying the Commissioner of the time and place of hearing, whose duty it shall be to give notice thereof to all parties who appear to be interested therein, in such manner as said judge shall prescribe. The Commissioner shall also lay before the said judge all the original papers and evidence in the case, together with the grounds of his decision, fully set forth in writing, touching all the points involved by the reasons of appeal, to which the revision shall be confined. And at the request of any party interested, or at the desire of the judge, the Commissioner and the examiners in the Patent Office, may be examined under oath, in explanation of the principles of the machine or other thing for which a patent, in such case, is prayed for. And it shall be the duty of said judge, after a hearing of any such case, to return all the papers to the Commissioner, with a certificate of his proceedings and decision, which shall be entered of record in the Patent Office; and such decision, so certified, shall govern the further proceedings of the Commissioner in such case: *Pro-*

vided, however, That no opinion or decision of the judge in any such case shall preclude any person interested in favour or against the validity of any patent which has been or may hereafter be granted, from the right to contest the same in any judicial court, in any action in which its validity may come in question.

SECTION 12. *And be it further enacted,* That the Commissioner of Patents shall have power to make all such regulations in respect to the taking of evidence to be used in contested cases before him, as may be just and reasonable. And so much of the act to which this is additional, as provides for a board of examiners, is hereby repealed.

SECTION 13. *And be it further enacted,* That there be paid annually, out of the patent fund, to the said Chief Justice, in consideration of the duties herein imposed, the sum of one hundred dollars.

Approved, March 3d, 1839.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1839,

With Remarks and Exemplifications by the Editor.

1. For *Valves for Canal Locks;* William Lake, Richmond, Virginia, June 7.

The patentee remarks, that "the valves of canal locks are subject to a pressure, the intensity of which is measured by the height of the head and the area of the valves; and this pressure on the common sliding valves for locks of ordinary lifts, is of such magnitude, and requires the application of so great a force to open them as greatly to detract from the superiority which they otherwise possess."

"My improvement consists in giving such form to the valves and apertures that, by the momentary application of a very small force in opening a small orifice, I apply the hydrostatic pressure in such a manner as to open the valves. Upon the back of the valves, closing the aperture through which the water flows in filling and discharging the lock, I attach a flanch of the same length as that of the aperture, and of such a width as to have the same proportion to the width of the valve as the friction of the valve on the seat has to the pressure. At the lower edge of the valve, below the flanch, I make an orifice of about one inch in width and about half the length of the valve; this orifice I open and shut by means of a lever and connecting rod."

We were about to make further extracts from the specification, but find that in so doing we must occupy more space than is convenient to allow to the subject; and after all, should probably fail to give a clear idea of the construction without the aid of the drawing; we, therefore, skip over to the concluding paragraph.

"I have represented the valve as fixed in a lock-gate, but I by no means intend to restrict myself in my said improvement to valves placed in this particular situation; neither do I claim as my invention the manner of applying the lever and screw as exhibited in the drawing. What I do claim as my invention, and desire to secure by letters patent, is the application of the hydrostatic pressure, to open sliding valves for canal and river locks, and making such improvements in the construction of the said valves, and

in the form of the apertures to which they are applied, as will adapt them to the application of this pressure, as herein described."

2. For an improvement in *Lamps;* Patrick J. Clark, Meriden, New Haven county, Connecticut, June 7.

The improvement is in the screw head tube and feeder, and is represented as applied to common chamber lamps. "The object is to fill, or feed the lamp through an orifice in the cap of the screw head, without removing it, and without the use of a separate feeding tube, thereby making a neater article, more easily managed and kept clean, and less liable to leakage and to accidents."

The screw-cap is to be perforated on one side of the wick, between the wick and the rim, so as to form a semicircular opening through which oil may be poured. A separate cap, perforated to allow the wick-tubes to pass through, slips on over the screw-cap, and is to be held in place by a pin. The claim is to "the improved mode of constructing the screw head for lamps, which consists in forming them with an aperture on one side of the wick, through which the oil can be poured, as herein specified. I also claim the cap, and the mode of securing that and the wick as specified."

3. For *Stirrups* for saddles; John Carrel, Petersburg, Dinwiddie county, Virginia, June 7.

The general construction of this *spring stirrup* is made known in the claim which is "to the employment of a spring acting in a suitable frame at the top of the stirrup; said spring, with its appurtenances, being constructed, combined, and operating substantially in the manner herein set forth, its object and use being to relieve the rider from the effects of those sudden jerks which are frequently experienced when riding with stirrups of the ordinary construction."

The stirrup-strap is attached to a sliding-piece, above which there is another sliding-piece borne down by a spiral spring, the whole being contained in a frame occupying the ordinary place of the eye at the top of the stirrup.

4. For improvements in the machinery for *Spinning Wool;* Isaac B. Hartwell, Northfield, Washington county, Vermont, June 7, antedated February 22.

The specification of this patent occupies twenty-six pages of record, and refers throughout to drawings. The claim, if given, would not afford any light as to the construction of the respective parts, and we are compelled, therefore, to abandon the task of furnishing a brief description of this apparatus.

5. For an improvement in the *Boot Crimp;* Joseph Sanderson, Cincinnati, Hamilton county, Ohio, June 7.

"The invention claimed, consists in the construction of the wedge-shaped mortise and key, with grooves, tongues, and offsets, for the insertion of, and holding the edges of the upper, or leather, whilst crimping it."

6. For an improvement in the *Cotton Gin*; Henry Conklin, Poughkeepsie, Dutchess county, New York, June 7.

This gin is of the roller kind, intended for the ginning of long staple

cotton. In a suitable frame there are "two rollers about one and a half inch in diameter, made of wood, iron, or other metallic substance;" directly in front of the said two rollers, and close to the junction of them, is fixed a *detainer*, about three thirty-second parts of an inch in diameter, to stop the seeds of the cotton, and thus prevent their coming in contact with, and being crushed by, the rollers, while they draw the cotton from them; the detainer may be made of iron, or any other substance, and is strained tight by screws, or in any other manner that will answer the purpose. "What I claim is the detainer placed in front of the rollers, as described."

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7. For an improvement in the *Machine for twisting Silk;* Gamaliel Gay, Philadelphia, June 7.

The device which is the subject of the patent before us, is denominated by Mr. Gay, a delivering roller, and will be found in the description of that gentleman's machinery, Vol. xxiv. p. 175. The claim is to "the combination of a roller, such as is described, with the machinery for twisting silk; said roller being constructed with a hollow, or groove, around which the thread, or fibre, is to be wound in its passage to the spindle."

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8. For *Preventing Friction in the steps of Vertical Shafts;* Stephen Parsons, Edgecombe, Lincoln county, Maine, June 7.

"The nature of my invention consists in providing a set of anti-friction washers, of a particular construction, placing them under and around the end of a perpendicular shaft, spindle, or pivot of a shaft; or when the nature of the case requires it, I reverse this order, and place said washers in the end of a shaft or gudgeon."

We shall not stop to give the particulars of the manner in which the patentee forms his washers, as the general intention will be perfectly apparent; but will dismiss the matter by confessing that we cannot see why the placing of several washers, one above the other, should decrease the friction, as we do not believe that there will be any motion excepting at the lower end of the spindle, or between some two of the washers.

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9. For *Making Hub-bands for Carriage Wheels;* Samuel Farrand, city of Newark, New Jersey, June 11.

The claim under this patent is to "the manufacture of hub-bands for carriage wheels, by means of rollers formed and operating substantially in the manner herein described;" and in this manner of operating there is very little novelty; although, it seems that the office found enough in it upon which to grant a patent, which should, most assuredly, be done whenever there appears to be any thing that is new in the thing claimed; this novelty, however, be it more or less, should be distinctly pointed out, which was not attempted in the foregoing claim.

The machine consists of two rollers, mounted in the manner of those of a flatting mill, the ends projecting through one end of the frame so as to admit the passing of the welded band to be rolled between them. The upper roller rises by the action of a spring, and is forced down by that of a screw; and when the hub-band is placed between the rollers, the upper one may be forced down, the band being kept in place by a sliding poppet on the bed of the machine.

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10. For *Cutting Screws on Wooden Framing;* S. H. Wills, Abington, Washington county, Virginia, June 18.

This machine is said to be for cutting right and left male and female screws for framing purposes. The principal object, we suppose, is to cut such screws upon the posts and rails of bedsteads, in such manner as that the screw at each end of the rail shall come up to a shoulder in each post, so as to cause them all to stand correctly with each other. This is not the first machine that has been patented for that purpose, and we have no doubt that there would soon be twenty others were they in demand. It would be a waste of time and space to attempt a description of the particular arrangements made by the present patentee, or to give the claims, as they refer to this special arrangement. If we wanted a machine for such a purpose we should not find the slightest difficulty in making one, without obtaining, or infringing, the right of any patentee.

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11. For an improvement in *Locks for Doors, &c.;* Erastus Finney, Cleaveland, Cuyahoga county, Ohio, June 18.

This is a combination lock, in which circular plates, or disks, are to be set by means of letters, or figures, under the particular arrangement made by the patentee. In the numerous devices of this kind there is usually much more of ingenuity than of utility, and they stand no chance whatever, therefore, of coming into general use. The claim made in the present instance is to "the employment of a cylinder revolving within a socket, or two or more cylinders revolving one within the other, having holes in their peripheries which can be made to coincide, or not, in the manner and for the purpose described."

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12. For an improvement in *Spectacles;* Daniel Thoxter, Hingham, Plymouth county, Massachusetts, June 18.

These spectacles are of the kind which have side glasses united by joint pins to the frame of the front glasses, and the improvement claimed consists in the manner of constructing "the joints uniting the frames of the front and side glasses so as to bring the front and side glasses into contact; and also the attaching the bows to the frames of the side glasses instead of continuing them across the side glasses to the joints, substantially as described."

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13. For a *Straw-Cutter;* Willis Grantham, Marshall's Ferry, Grainger county, Tennessee, June 18.

In this straw-cutter the straw is to be placed vertically in a hopper situated over a revolving cylinder, which carries a knife at such distance from its periphery as shall conform with the length of the cut stuff. A block within the hopper is made to press the straw during the time the knife is cutting, the pressure being removed in the interval to allow the straw to descend.

The claim is to the combination of the vertical hopper, feed-roller, apron, and press-block; and these parts thus combined in combination with the rotary diagonal knife, in manner substantially as set forth.

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14. For an improvement in *Rake Teeth;* Hezekiah Haynes, Middletown, Rutland county, Vermont, June 18.

The teeth of this rake are made of wire, inserted in, or secured to, the rake head, and then bent round said head so as to form a spiral spring. The pa-

tentee does not claim the forming the teeth of elastic wire, but only "the obtaining this elasticity more effectually by coiling the wire of which the teeth are made around the head of the rake, in the manner and for the purpose described."

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15. For an improvement in *Stoves;* Horace Bushnell, Hartford, Connecticut, June 21.

This patent is taken, mainly, for the construction of an oval valve, and the manner of placing it in a stove pipe, so as to change the direction of the draught, after a coal fire has been lighted, causing it to descend, and circulate through greater length of pipe, or other heating surface. In the object to be attained, there is here no novelty, and in the means of accomplishing it, just enough upon which to found a claim; with regard to utility, the same amount of this has been obtained by analogous arrangements.

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16. For *Cutting Boots and Shoes;* Jeremiah B. Keen, Bridgeton, Cumberland county, New Jersey, June 21.

"The principal features of this improvement in making boots and shoes, consist in cutting the vamp, quarters, and sole, in a single piece, instead of in several pieces as heretofore, and thereby having but one seam, the vamp, and that at the side; and in cutting a half stiffening to each quarter; which system will enable the maker to extend the cut from a shoe to a boot, which will entirely prevent the necessity of crimping." Patterns are exhibited in the drawing, showing the manner of cutting, and to these patterns the claims refer.

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17. For *Reversing the Motion of Steam Engines;* Jacob D. Custer, Norristown, Montgomery county, Pennsylvania, June 21.

Claim.—"What I claim as my invention is the attaching of the governor balls in steam engines to the fly wheel of the engine, and the connecting them to the eccentric in the manner herein specified, by which means the eccentric is made to move backwards and forwards in relation to the dead points of the crank, and thus cuts off the steam shorter or longer.—Also, the mode of reversing the motion of the steam engine by means of a spring-latch attached to the tube of the shifting eccentric; which latch has a projecting pin upon it, which falls into notches placed on the nave of the wheel, and out of which notches the latch is raised by means of a lever and ring when the engine is in motion, as described."

The description of the manner of applying these devices is of great length, and has numerous references to drawings.

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18. For *Springs for Railroad Cars;* Patrick Riley, Shamokin, Northumberland county, Pennsylvania, June 21.

A bow-spring under the side timbers of the carriage, has its middle resting on the axle boxes; and its ends bearing against strong spiral springs contained in tubes fixed to the underside of the rail. The claim is to "the application of the spiral springs combined with the inverted arch, or bow-spring, or plate, to locomotives, railroad cars, or other objects, in the manner described."

19. For an improvement in *Cocks applicable to the drawing of Molasses, &c.;* Charles F. Johnson, and John J. Speed, Ithaca, Tompkins county, New York, June 21.

To the back end of the cock, which is inserted in the barrel, a conical valve is adapted, and from this a wire rod extends along the axis of the cock, passing through its fore-end. By pressing against a button on the end of this rod, the valve is forced back, and the liquid runs out. To close the cock, the valve is drawn forward, it having been found that a spiral, or other spring is not necessary to its being securely closed. The claim is to "a stop-cock furnished with a simple conical valve, and operating by means of a rod, without spiral or other springs, as set forth."

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20. For *ascending and descending Inclined Planes on Railroads;* Jonn Mercer, Harrisville, Harrison county, Ohio, June 21.

The proposed mode of ascending inclined planes is much like several others patented, or proposed. There is to be a cogged rail on the centre of the track, into which a wheel on the under side of the locomotive is to gear. The cogs, or teeth, are on the sides of the rail, the top being smooth. The cogs are placed alternately on the opposite sides of this centre rail. The claim is to "the peculiar construction of the centre wheel, being in two parts connected together so as to bring the cogs of one wheel opposite the spaces of the other;—and the peculiar construction of the cogged rail, in having cogs projecting from the sides thereof, to prevent the lodgment of obstructions on the rack; the cogs on one side being opposite the spaces between them on the other, and the section of the rail at the commencement of the inclined plane having its teeth made triangular for the gradual and easy introduction of the cog wheel to the rack."

The plan proposed, and above set forth, does not obviate any of the essential objections to the ascending of inclined planes by means of rack-rails. The friction of rack-rails on level ground is very great, but on inclined planes it is greatly increased; there is from this cause a perpetual danger of the lifting of the locomotive, besides other difficulties which need not now be urged.

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21. For an improved *Emery Wheel for dressing Iron;* John G. Tibbots, city of New York, June 21.

The emery wheel, made in the usual manner, is to be suspended in a frame, or at the end of arms, which can rise or fall at pleasure. The iron, or other article to be dressed, is placed on a suitable table, the top of which may be made to move laterally. The wheel may be driven by bands and whirls in the usual way. The claim is to the mode of suspending the emery wheel, by means of the balance hanging frame, in combination with curved guides.

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22. For *ascending and descending Inclined Planes on Railroads;* John Drummond, Elizabethtown, Essex county, New Jersey, June 21.

Among the various plans for ascending inclined planes, that before us appears to be one of the least promising. The locomotive and cars are to be driven on to a carriage at the foot of the inclined plane, the wheels of which carriage must rest upon rails, sufficiently below those of the ordina-

ry track to cause the top of the said carriage to coincide with them. Upon this carriage the locomotive is to be made to move up the plane by means of a contrivance superabundant in friction. On the face of a driving wheel on each side of the locomotive, there is to be a projecting fillet, in a spiral, or scroll-like, form, which is to take in between the teeth of rack-rails erected on posts on each side of the track; and by the turning of the driving wheels the load is to worm its way up.

We shall not take the time requisite to describe or descant upon the various devices referred to and described, for managing the apparatus, as we think that the leading principle is obviously liable to so many objections as to render this superfluous; nor shall we give the claim, as this refers to several things which we have not noticed.

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23. For an improvement in *Bedsteads;* John Hart, Nicholasville, Jessamine county, Kentucky, June 21.

The rails of this bedstead are to be let into the posts by round tenons, allowing the rails to revolve on them as on pivots. The rails are to be furnished with pins upon which to hitch the rope, or sacking cord. There are levers let into holes in the side and foot-rails, which when the rope is hitched on to the pins, have one of their ends on the floor; these levers are to be raised to a horizontal position, thereby revolving the rails, and tightening the cords; the levers are then to be fastened by a rope, or otherwise, in the horizontal position. The arrangement and combination of the rails and levers constitute the claim, and a very vulnerable arrangement we think it; in this respect however, it does not stand alone, excepting in so far as it may belong to the bottom of its class.

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24. For making *Cotton Roving;* Jesse Whitehead, Manchester, Chesterfield county, Virginia, June 24.

"The nature of my invention consists in a method of giving to the spools of a countertwist speeder, a steady receding motion, regulated by the increasing diameter of the bobbin, to preserve the same distance between the surface of the bobbin and the guide through which the roving passes, by means of the application of stationary inclines, or guides, to the frames of the bars holding the spools."

The claim is nearly in the foregoing words, containing the statement of the design of the invention. The manner of carrying this design into effect could not be made known without reference to the drawings.

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25. For a *Corn-Sheller, Hulling Grain, &c.;* John Mercer Harrison, Harrisville, Harrison county, Ohio, June 24.

This machine consists of a cylinder revolving within a concave, the surface of which being covered with segments of cast iron, ridged in a way described and represented in the drawing; the parts being regulated by tempering screws. The peculiar arrangement of these parts constitutes the claim, but this is not very clearly described or represented. So far as we can see into the matter, without devoting more attention to it than is convenient, we do not find any thing worthy of special notice.

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26. For a *Planting Machine;* Moses Atwood, Jr., Hempstead, Rockingham county, New Hampshire, June 24.

This machine is intended for planting corn, and other large seeds; its general character assimilates it to a number of others made for a like purpose, but there is considerable peculiarity in the arrangement of its parts, and this arrangement constitutes the subject matter of the claims, which are to "the combination of the box containing the corn to be planted, with a pulley-box and small hopper, and adjustable bucket-belt, with its buckets for taking up the corn. Also, in combination with this arrangement, the adjusting bar for regulating the length of the bucket-belt; the lever and slide for regulating the supply of corn to the pulley-box; the lever and slide contained in the pulley-box for admitting and shutting off the supply of corn to the same, together with the pulleys and cam for lifting the levers so as to admit a supply of corn into the pulley-box, all substantially as described."

After this long catalogue of items, no one, we believe, will expect, or desire, a description of the respective parts, and, without further information, the inference appears to be a necessary one, that where a patent is dependent upon so many small particulars, without any leading feature of novelty, to stand out in bold relief, its loop-holes must be numerous.

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27. For machinery which may be used in *Spinning Hemp, Flax, and other fibrous materials;* Moses Day, Roxbury, Norfolk county, Massachusetts, June 24.

This is said to be "an improvement in machinery for producing a reciprocating motion," which is applicable to the above named purposes—the invention being for "the object and purpose of producing a rectiliniar motion of the bobbin or spool, through the flyer, in order to distribute or wind the yarn on the bobbin as the same is spun or twisted, or delivered, by the regulating capstan." The method of giving the reciprocating motion to the bobbin is, by cutting a right and left-handed screw, upon the same portion of a shaft, or spindle, the threads crossing each other, into the threads of which screw a guide-piece fits, which guide-piece is so arranged as that by shifting it, the motion may be reversed, and rendered reciprocating; so far there is not any novelty in the plan, but by means of a pulley, with its tongue, or fork, and certain other parts represented, and claimed, a screw with coarse threads may be used, so as to lessen the friction, and still produce the desired effect. Whether the manner described of producing the reciprocating motion is superior to others before in use, is a question which we are not prepared to answer.

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28. For a machine for *Hulling Clover and other Seeds;* Abraham Keagey, Morrison's Cove, Bedford county, Pennsylvania, June 24.

In this machine there is a combination of rubbing cylinders, and concaves, wind passages, and a blowing apparatus, which has the merit of ingenuity and of some novelty. The claim is to certain peculiarities in the arrangement of the parts, including "two hulling cylinders revolving in the same direction, furnished with rows of teeth and graters, alternately, as set forth, and having a double concave grater above the said cylinders, with the respective apertures combined and connected as described."

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29. For an improvement in the mode of *Manufacturing Carbonate of Soda;* John Hemming, of England, and Edward Dyer, a citizen of the United States, June 24.

The specification of this patent is published in Vol. XIV. of Newton's Journal, p. 400, and from this we republish it, the English and American patents being similar.

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30. For improvements in the construction of *Bridges;* Henry Wilton, Wrightsville, York county, Pennsylvania, June 24.

"The nature of these improvements consists in combining the right line, or horizontal bridge, with the arch bridge, in a peculiar manner." The general construction of this bridge is the same with that patented by Mr. Town, the sides, or trusses, consisting of lattice work, composed of small timbers pinned together at their crossings. Two of these are to be connected together by transverse beams and diagonal braces; and arches are to be arranged at the sides of the trusses, one on each side of each truss, the ends of which arches have their bearings or off-sets on the abutments and piers, between the floor of the bridge. The arches on each side of each truss are to be screwed together by screw-bolts.

The claims are to the employment of vertical braces, and the horizontal bolts, in combining the arch with the right line or lattice bridge.

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31. For an *Umbrella Runner;* Joseph Barnhurst, Francisville, Philadelphia county, Pennsylvania, June 25.

This patent is taken for an improvement upon an umbrella runner, of French invention, consisting of two tubes, one of which is contained, and turns to a certain distance, within the other, for fastening the umbrella when open. The difference between the two runners is not great, but sufficient novelty and utility was found in the improvement to cause it to be deemed worthy of a patent; it would not, however, be a very interesting matter to give a long detail of these minor differences in constructing and arranging said tubes.

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32. For a *Planting Machine;* John W. Forrest, Princess Ann Court House, Virginia, June 25.

A hollow wheel, or drum, is to roll upon the ground, its axis running in a suitable frame; within this drum the seed is to be placed, and it is to drop through a hole, or holes, in its periphery. For corn, and other large seeds, there may be but one hole, but for small grain the periphery of the drum is to be perforated with numerous holes. "This invention may be attached either to a harrow or a plough, and by widening the cylinder and increasing the number of holes, may be used for broad cast, and this invention as thus set forth, is all that I do claim, it being distinct from the plough, harrow, mould-boards, and outer plough frame, which I do not claim."

This seems to us to be one among the least promising of all the planting and sowing machines which we have had occasion to notice, it being deficient in the provisions which appear necessary to equal dissemination, a point of great importance in the operation.

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33. For a *Stump Machine*; Benjamin Burling, Catharine, Chemung county, New York, June 25.

This is a very simple machine, "consisting of a lever, which is usually from fourteen to twenty feet in length, to one end of which is fixed a clevis, furnished with hooks, or dogs, or other contrivances, for taking hold of the

stump. The end upon which the lever bears, and which constitutes its fulcrum, is formed into a quadrant of a circle, which is to be sustained upon a proper bearing, or bed piece, placed upon the ground, and upon which the curved part of the lever rolls as the stump is extracted. When the dogs or hooks of the lever are first attached to the stump to be raised, said lever is placed in a vertical position; it is to be drawn down, and the stump raised, by animal or other power, drawing by ropes or chains attached to its upper end." The step upon which the curved lever rests may be made of strong planks, and have cheek pieces, forming it into a trough, which, presenting a wide bottom, will not sink into the ground. The claim made is to the manner of constructing the foregoing apparatus "so that by the operation of the curved end of the lever, resting on the step, and furnished with the clevis and dogs, formed and operating substantially as set forth, stumps may be raised and extracted from the ground, in the manner described."

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34. For a *Safety Hook, for tow lines;* Thomas Jackson, Reading, Berks county, Pennsylvania, June 25.

This is a safety hook which is to be attached to a swingle tree, for towing canal boats. "In this safety hook the towing line may be cast off and replaced without the necessity of making use of the trigger, which is not the case with those formerly used. The trigger also must be disengaged by pressing on it below instead of above, whilst in the old hooks it was acted upon on the upper side, and was not unfrequently disengaged accidentally by a blow from the tail of the horse, a thing which cannot possibly occur under the present arrangement."

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35. For *Preventing Smoke, and Saving Fuel*; Sarah Hammond, city of Baltimore, June 25.

The claims under this patent are, "First, the constructing of a hearth on the base of an ordinary fire place, of the form specified, by which means a raised flue is formed between the top of the centre of this hearth, which is lower than the ends, and the bars or grate on which I place the fuel."

"Secondly, the placing of the bars for supporting this fuel on the top of the raised hearth, from end to end, across the said flue, as herein described."

"Thirdly, the placing of the fender along the upper edge of the raised hearth, from jamb to jamb, across the said flue."

"Lastly, I claim the said hearth, fire grate, and fender, in combination, all as specified."

The whole device referred to in the above claims, consists of an elevation formed on the common hearth, even with the jambs, and probably eight or ten inches in height. In the centre of this elevation there is a recess, which is to form a flue and an ash pit; on the top of this are to be laid grate bars, which are flush with the elevated hearth; a fender is placed in front, to prevent the fuel from falling down, and behind the bars there is to be a soap stone back log.

Imitating the politeness of the officers who granted this patent, we will not offer a word of discouragement to the fair patentee, but will indulge the hope that her hearth may be one of comfort, and her fire place one of profit.

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36. For *Broom Heads*; Isaac Cheney, Leyden, Franklin county, Massachusetts, June 25.

A piece of sheet metal, cut into proper form, is to be doubled over, so as to embrace the fibres forming the brush between them. Through the edges of this clasp, wires furnished with screw nuts are to pass, and by tightening them the fibres will be bound together. A ferule to receive a handle may be affixed to the upper part of the clasp. The claim is to the foregoing mode of making and fastening broom heads.

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37. For a *Machine for Cutting and Grinding Corn with the Cobs*; Joseph C. Baldwin, Augusta county, and Cyrus B. Baldwin, Batetout county, Virginia, June 26.

The claim under this patent will afford a good general idea of the construction of the machine as claimed; it is as follows:

"We do not claim to be the inventors of toothed iron cylinders, or to be the first who have applied them to the grinding and crushing of corn and other grain; but we do claim to be the inventors of a machine for that purpose such as is herein described, in which the article to be crushed or ground is successively acted upon by crushing and grinding cylinders standing in part the one over the other, and combined with a small grinding cylinder and concave, constructed and operating substantially in the manner set forth."

The cylinders are of cast-iron, fluted or ridged, and running together with different velocities. The arrangements appear to be good, and the machine is said to be effective.

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38. For an improvement in *Clocks*; Noble Jerome, Bristol, Hartford county, Connecticut, June 27.

We cannot attempt to explain the nature of the respective improvements which constitute the subject of this patent. The manner of placing the count wheel on a stand or socket; of confining it by means of a spring; the making of the count wheel of a single plate of metal; the moving of it by means of a single dog, together with certain other matters, constitute the things claimed.

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39. For a *Portable Oven*; Thaddeus B. Curtis, New Dover, Connecticut, June 27.

This oven is formed of double plates, as also are the shelves within it, the spaces constituting flues through which the draught is to be made to pass back and forth. By connecting the pipe of a cylindrical, or other, stove, with the lower part of this oven, and having a pipe at its upper part, to lead into a chimney, the oven may be heated. To an oven so combined and arranged the claim is made.

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40. For a Machine for *Counting Pills*; Joseph Priestly Peters, city of New York, June 27.

"I make a trough or box, which I divide into three or more compartments, extending from one side of it to the other; the two end compartments only, when there are three, constitute the hoppers into which the pills or other substances to be counted are to be put. To this trough I adapt a sliding bottom which is perforated with holes, the thickness of said bottom, and the diameter of the holes being governed by the size of the bodies to be counted. When the perforated part of this bottom is made to occupy the

lower part of one of the hoppers, one of the spherical bodies contained in said hoppers will fall into each of the holes or perforations, and may be carried by the sliding of the bottom into the centre division of the trough or box, whence each of them is to fall, and be conducted by means of a suitable funnel into a box placed below to receive them." There is, of course, under the perforated slide, a solid bottom to each hopper, whilst the middle compartment is open below. The boxes to receive the pills, &c., are placed upon a sliding shelf below the funnel, which shelf is regularly moved forward.

The claims are to "the manner of separating and counting the proper number of such bodies, by causing them to be received within perforations prepared for and adapted to them, whether in a sliding, vibrating, or rotating portion of the machine, so arranged as to operate substantially in the manner of the sliding bottom and its appurtenances, as herein described; by means of which they are conveyed from a hopper or compartment in which they are placed, and delivered into a funnel, and by that conducted into the boxes or other receptacles arranged for that purpose, as set forth."

The above described machine is simple in its construction, and perfect in its operation. We say so because we have had occasion to try it; but even without this there would not have been any difficulty in deciding upon its merits.

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41. For *Sawing Blocks for Friction Matches;* Jonathan Morgan, Portland, Maine, June 27.

Blocks for friction matches, it is generally known, are cut by gangs of circular saws so as to cut nearly through the block, but yet to leave the matches attached to each other at one end; the present patent is taken for adding to the gang one additional saw of larger diameter than the others, which shall separate the individual blocks from each other. The additional saw is the only thing claimed.

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42. For *Trusses for Hernia and Prolapsus Uteri:* John M. Sinton, Hacketstown, Warren county, New Jersey, June 27.

The patentee says, "In my truss I do not make use of a spring to pass round the body and make counter pressure on the back; but the apparatus to which the pad or pads are attached, consists of a corset or jacket, reaching round the body and laced or tied behind, in the manner of ordinary corsets. When my truss is employed for the relief or cure of Hernia, I employ two pads, although the rupture may be on one side of the groin only, a plan to which I have recourse not only because the particular structure of my truss requires it, but also because by this means the pressure upon the rupture is rendered more equable, and as affording security against the occurrence of rupture on the sound side. When my truss is used for prolapsus uteri, I adopt a larger pad suited to the purpose, to take the place of the hernial pads." The piece to which the pads are attached passes up like a corset bone, but has a sliding motion up and down, and at its lower part there is a ratchet and catch, to alter the pressure of the pads, attached to two spring pieces, which, however, are not to have much elasticity.

The claims are to the combination of the spring pieces which carry the pads with the sliding piece, attached to and operating in a jacket or corset, as described.

43. For an improvement in *Piano Fortes:* John J. Wise, Baltimore, Maryland, June 27.

This patent is taken for an improvement on the German action, the particular arrangements of the parts we shall not attempt to describe, but content ourselves, and probably most of our readers also, by giving the claim, which is to the combination of a detached key with a lever at its inner end, having its fulcrum at the back of the piano, and projecting over the inner end of the key, by which it is raised when the key is forced down; and having the capsel, or upright, which carries the hammer, attached to the end projecting over the key, instead of being attached to the key as in the German action; and in combination with the above, the placing of the catch (which operates in the same manner as in the German action,) nearer the key board than the hammer is, the position of the hammer handle being reversed, which is the opposite of the German action; combining with this arrangement the regulating screw, as described in the specification.

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44. For *casting a Double Suction Pump:* Foster Hevshard, Brookfield, Worcester county, Massachusetts, June 29.

The specification and drawings present a particular mode of combining iron rods around which the cores for casting the pumps are to be formed, so as conveniently to cast the barrels of a double forcing pump in one piece; and the claim made is to the particular arrangement of these rods, which is such as to enable them to be detached, by unscrewing, from the parts with which they are connected.

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45. For improvements in the *Suction and Lifting Pumps:* Humphrey L. Hughes, Warren county, Virginia, June 29.

In the specification of this pump a number of proposed improvements are described, but they consist, in general, of devices substantially the same with such as are known to those familiar with what has been done in this way, and the claim, therefore, is restricted to a single item of these proposed improvements, the object of which is to facilitate the removal of the lower box; this is effected by giving to the bale which rises from that box considerable length, so that it shall rise to a height above the box, more than equal to that of the stroke of the pump. An iron rod extends down from the upper box, or piston, and slides through a hole in the top of the bale; this rod has a head at its lower end, and, consequently, when the upper box is raised, it draws the lower box with it. The claim is to this arrangement, which is one that we, most certainly, would not use, for various reasons; among which are the following: The sliding bolt has to be lifted perpetually, in addition to the weight of the other parts; the piston cannot be removed without also removing the lower valve, which must therefore be disturbed, whether it is required or not; and lastly, it obviates no difficulty, as the lower box may be easily hooked up when necessary, which ought not to be once in a year. A common mistake in the theory of the pressure of water is put forth in this specification, namely, that "the box of the pump stock is generally too large, causing too great a weight of water to rest on the valves." Now it so happens that this weight is proportioned to the altitude and the size of the valve, and bears no relationship whatever to the size of the bore of the pump.

46. For *Cutting Staves:* Jonathan Burt, of Sullivan, and Erasmus Smith, of Norwich, Chenango county, New York, June 29.

A knife, properly curved, is placed upon two arms, the length of which corresponds with the curvature to be given to the stave crosswise. A crank shaft, having a crank at each end, is connected to the arms by two shackle bars, which, when the shaft is made to revolve, give a reciprocating motion to the knife. The stuff to be cut is to be steamed, and fed up to the knife by means of a suitable apparatus; the knife must, of course, be as long as the stave to be cut.

The claim is to "the mode of communicating motion to the cutting knife from the crank shaft placed below it, whilst the knife itself is made to move in the proper curve to be given to the stave, by means of the arms upon which it is hung."

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47. For a *Truss for Prolapsus Uteri:* Albran Pateet, Danville, Hendricks county, Indiana, June 29.

There is not anything of a special character in this truss by which to designate it, but simply some variation of arrangement; the claims are to the manner of constructing the spring which passes round the body, in combination with a bifurcated strap attached to its end, in the manner represented in the drawing.

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48. For *Window Blind Fastenings:* Mileden N. Isbel, New Haven, Connecticut, June 29.

This patent is taken for merely adding a spiral spring to certain well known blind and shutter fastenings, so as to insure their action as latches, or catches, instead of depending upon their gravity alone.

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49. For a machine for *Cleaning Wheat:* George Mann, jr., Lockport, Niagara county, New York, June 29.

This machine, like most others for the same purpose, presents the form of a vertical cylinder, the exterior of which consists of vertical staves, or grating, the bars composing which are placed at such distances apart as to allow dust to pass out between them; the revolving part within causes the grain to be rubbed against cast-iron flutes, and perforated sheet iron, the latter operating like a grater; the wheat is also to be rubbed, as it descends, by revolving brushes against the interior of the cylinder. Air is to be drawn in through tin tubes, which air, as it passes out between the staves, is to carry with it the dust produced by the friction of the grain. The claims are to the making the cylindrical case with openings as described; to the combination of the fluted rubbers and brushes; and to the combination of the rubbers forming the top of the cylindrical case, and a revolving disk below it.

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50. For an improvement in *Spectacles:* Christopher H. Smith, Niagara Falls, Niagara county, New York, June 29.

The frames of these spectacles are to be made like those in common use, with temple frames of the ordinary construction, but there are not to be glasses in the eye frames, these being left vacant. There are, however, to be two pair of eye glasses in separate frames, one pair of which may be turned back against the inner side of the temple frame in a manner well

known; the other pair are so hinged that they may be turned back against the outsides of the temple frames, or brought round so as to cover the open eye frames, at pleasure. The glasses may be coloured, if required; they may also have different focal lengths, and may be used singly or combined, so as to furnish three different focal distances. The patentee calls those "revolving glasses," which turn back outside of the frame, as they turn three fourths of a circle.

The claim is to "the employment in spectacles of the revolving glasses, and the manner of screwing them to the rim, or apertures of the frames; also, to the mode of securing them to the outside of the temple bows." This latter claim refers to a catch by which the glasses when turned back, are held in place.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a patent granted to HENRY GRIFFITHS, *of the county of Middlesex, for improvements in the process of producing prints or impressions from steel, copper, or other plates.*—[Sealed 25th of May, 1839.

These improvements in the process of producing prints or impressions from steel, copper, and other plates, have for their object the production of imitations of drawings, by several successive operations of printing different colours or tints upon paper or other suitable material, each successive impression being so carefully placed as to register with perfect accuracy and fit the previous impression, in order that, when the several successive impressions have been so taken upon one sheet, tablet, or surface of paper, or other material, the whole shall produce the effect of a drawing or picture delineated in its various tints or colours with a camel's hair or other pencil.

In performing this process, it is necessary first to provide a series of three, four, or more plates of copper or steel, as many in number as may be required to produce the different gradations of tints or of colours in the drawing to be imitated; the plates must be produced severally by the ordinary processes of etching, stippling, qua-tinting, or mezzotinting, or other suitable modes of engraving the selected parts or portions of the drawing which are to be represented by the particular tint or colour printed from each individual plate.

When the several plates have been thus engraven, there must be lines or registering points marked upon all the plates accurately corresponding, in order that the first impression upon the paper may exactly register with the parts of the subject upon the successive plates.

The patentee has accompanied his specifications with a series of prints, taken in the several stages of the operation, which it must be obvious we are unable to give examples of; and proceed to state, in reference to the production of such subjects, the manner of proceeding.—

Supposing, he says, that I am about to print a flower in colours in imitation of a drawing,—I produce upon a plate, by some of the modes of engraving above alluded, the form of the pale yellow part of the flower, which I then print upon the paper; I next produce a plate, having only that part of the flower engraven on it which is to represent the central bright tint and the green stalk which I print upon the former impression. A third plate is then provided, having the forms of the shadows only; this is to be printed upon the two former. And, lastly, I produce a plate on which is engraven

the deep purple tint of the flower, and having printed the last upon the three preceding impressions, I hereby complete the picture of the flower.

Again, supposing that the subject of the drawing to be imitated is a landscape;—I engrave a plate with the forms only of the grey tints, representing hills and sky, and parts of the foreground, and having printed this, produce the imperfect or first stage of the picture; a second plate is then provided, having only the forms of the yellow tints of the drawing, which is to be printed on the previous impression, and which will thus give to the picture the second stage of advancement; a third plate is then to be employed, having only the shades of the brown colour and broad shadows of the picture, which being printed upon the two preceding impressions, gives a resemblance of the landscape drawing in a further advanced stage. Lastly, I provide a plate, having the stronger or more powerful parts of the picture engraven on it, and having printed this upon the three previous impressions, produce a finished copy of the drawing, which I desired to imitate.

The patentee further remarks, that he does not always print with oil colours, as some of the tints, designed to imitate water colours, would lose much of their brilliancy and delicacy if mixed with oil; he therefore sometimes employs moist water colours for printing; but, wherever brilliancy and purity are essential, he prefers to use the colours in a dry powdered state.

The process of printing with oil colour is so well known as to render any description of it unnecessary. That of printing from moist water colours has also been of late in use; but, if not generally known, it is merely necessary to observe, that the parts of the plate to be printed by moist water colours, are covered by a small dabber, and the smooth surface of the plate wiped clean by a damp rag.

In printing with dry colours, I first grind the colour with pure water or spirits of wine, and, when dry, reduce it to a very finely powdered state; I then apply the powdered or dry colour to the parts of the plate required by means of a camel's hair pencil, and carefully wipe off all the superfluous colour by the hand, or by a soft leather. The plate is then put into the press, and the damped paper laid upon it, and after the dry colour impression has been given to the paper, by passing the plate under the rollers, the successive impressions should be taken whilst the paper remains damp, excepting in cases where great force of colour is required, which may be promoted by drying the paper between each stage. Lond. Jour. Arts & Sci.

Specification of a patent granted to Moses Poole, *of the county of Middlesex, for improvements in constructing and applying boxes to wheels,—being a communication from a foreigner residing abroad.*—[Sealed 28th February, 1839.]

The patentee states, that considerable inconvenience and instability has been experienced from the ordinary mode of fastening into the wooden naves of wheels the iron boxes in which the axles run. That the longitudinal ribs usually formed on the outsides of the boxes, when inserted in its wooden naves and wedged up, soon become loose, to the great detriment of the proper action of the wheel. It is therefore proposed, as the subject of this patent, that the external surface of the iron box of a wheel, shall be

made with a helical thread or screw, winding several times round its periphery, in order that the box may be screwed tightly into the wooden nave, instead of fastening it in by ribs and wedges, as heretofore.

The screw may be formed on the outside of the iron box, by casting it in a threaded mould, or it may have a screw cut upon its outside in a lathe, or by other suitable or convenient means. The patentee does not confine himself to any particular sort of screw, but claims fixing the iron boxes of wheels in wooden naves by screwing them into the wood. Ibid.

Specification of a patent granted to Charles Wye Williams, *of Liverpool, in the county of Lancaster, for his invention of certain improvements in the process or the mode of purifying or preparing turpentine, rosin, pitch, tar, and other bituminous matters, whereby the power of giving out light and heat is increased, either when distilled or burnt as fuel.*—[Sealed 14th August, 1839.]

This invention consists in a peculiar mode of rendering the several bituminous matters, as turpentine, rosin, pitch, tar, &c. more effective, when used for the purpose of giving out either heat or light, by bringing such bitumens into intimate contact with atmospheric air, in order that several of the gases with which they are charged, and in particular the combination of ammoniacal gas, known to be injurious in the processes of burning for the production of light or heat. In order to afford the best information for carrying my said invention into effect, I give the following description of the process or means which I employ, namely:—I place the bitumen to be purified in a large pan, or vessel, over a fire,—and when raised to near the boiling point, I cause a second vessel, shaped and pierced with numerous holes, like a colander, to descend into the former; and when filled with the melted bitumen, to be raised suddenly a few feet, to allow the melted stuff to fall through in shower-like streams, by which, in the act of dripping down and returning to the first-mentioned pan, the melted material comes into extended contact with the atmosphere; the result of which is, that a large portion of the ammonia, and its combinations, and other gases, with which such bitumens are charged, are expelled or drawn off by the atmosphere.

This filtering or mixing process, by which the bitumen and atmospheric air are so brought in contact, is to be kept going on, until the material has received the required extent of purification, and which operation may be carried on as long as desired.

This process of lifting the bitumen, and allowing it to fall through the colander, or other shaped vessel pierced full of holes, may be effected by mechanical means, or simply by hand utensils.

The temperature to which the bitumen must be brought, should be about the boiling point; but varying, of course, according to the kind of bitumen operated on, and which a little practice will soon point out.

While this process is going on, I cause a strong current of atmospheric air to pass across the falling portions, drops, or streams, of the bitumen, by means of a fan or other well known mechanical means,—the object being to cause a larger admixture of air with the bitumen, in the act of falling or dripping down, and by which the ammoniacal and other gases, which are very volatile, are passed off in great quantities.

I do not intend to confine myself to bringing such bitumens to any par-

ticular temperature, or to continue this filtering or mixing process for any particular length of time; but intend to avail myself of any extent or continuance of this operation, until the air has sufficiently acted on the bitumen, with which it is thus mechanically brought into contact.

And whereas, the process of purifying the various bitumens above described, has been practised by other persons, I make no claim to purifying such materials by any other means; but I do claim that mode of purifying the same, by agitation and mechanical admixture with atmospheric air, and for the purpose of exposing extended surfaces of the bitumen to contact with atmospheric air. Ibid.

Specification of a patent granted to William Banks, *of the county of Warwick, for his invention of a certain improvement in machinery, pens, and presses, for ruling and pressing paper.*—[Sealed 17th August, 1835.]

This invention is a certain arrangement of machinery whereby paper may be ruled with lines of different colours, and submitted to hot or cold pressure at the same time.

The apparatus described in the specification, consists of a frame-work constructed of wood, iron, or other suitable material, and having at one end a flat table for holding the paper to be ruled and pressed. At the end of this table, and about the centre of the framing, two hollow rollers are placed, transversely, across the machine, and are mounted in suitable bearings, and are intended to press the paper.

Near these hollow rollers a cylindrical shaft or spindle (also placed transversely) is furnished with a number of instruments or pens for making the required lines. These pens are capable of very accurate adjustment as to the widths and thickness of the lines to be produced, and each pen is attached to a metal collar, which may be slidden along the cylindrical shaft, and firmly fixed in any required position, by means of a small thumb-screw attached to it.

Two metal or other rollers, one placed near the pressing rollers, and the other at the reverse end of the machine, carry tapes or bands for the purpose of keeping the paper, while being ruled, flat upon a wide endless band, which is extended across two rollers, placed below the tape rollers. A third roller, immediately under the points of the pens, raises up the endless band, and by that means keeps it in contact with the points, and also forms a solid and firm bed for the pens to act upon.

The paper to be ruled being placed on the table in front, is passed, sheet by sheet, between the hollow pressing rollers, which may, if required, be heated by means of hot irons. It is then conducted from them by the tape roller, and passed on to the endless band, and carried by that and the tapes under the points of the pens, from which it receives the required lines; it is thence carried forward by the tapes and endless cloth, and delivered at the other end of the machine on to a table, placed there for the purpose of receiving it.

The machine is set in motion by manual or other power, which is applied to one of the pressing rollers; the other parts of the apparatus being actuated by suitable gearing, or otherwise.

The pens are formed in such a manner that they will contain a sufficient quantity of ink to last for a considerable space of time without replenish-

ing; and each instrument being totally unconnected with any other, two, three, or more coloured lines may be ruled at one and the same time.
Ibid.

Specification of a patent granted to George Nelson, *of Milverton, county of Warwick, for his invention of a new or improved method, or new or improved methods of preparing gelatine, which has the properties of or resembles glue.*—[Sealed 23d March, 1839.]

This invention is described as consisting of an improved mode of preparing gelatine from the cuttings and trimmings of hides and skins, and is thus explained:—The cuttings, after been freed from the hair, fat, and other extraneous matters, are to be well washed in clear cold water. When sufficiently clean, the cuttings are to be submitted to the action of a solution of caustic alkali, made from common soda and fresh burnt lime, mixed with water. Previous to their being macerated, they should be scored all over to the depth of about the eighth of an inch, in order to facilitate the action of the alkali, in which they may be allowed to remain for about ten days; they should then be removed from the solution, and placed in an air-tight vat, lined with cement, and kept at a temperature of from sixty to seventy of Fahrenheit; after which they must be removed to a washing apparatus, consisting of a wooden cylinder, about three feet in diameter, which is made to revolve. A stream of water, being admitted into the cylinder, washes away all the alkali from the cuttings; and when sufficiently cleansed, they are removed to a wooden vessel, and submitted to the action of sulphurous acid gas, generated by the combustion of sulphur.

After this process, the water should be passed out of the cuttings, and they are then to be put into vessels, made of any material not liable to be acted upon by the acid,—such as earthenware,—and heated by steam, to the temperature of 150° Fahrenheit,—thus completing the process, the cuttings being then reduced to a gelatinous state. This product must be strained, in order to separate the pure gelatine from its residuum; and during this process, the gelatine is kept up to 100 or 120° Fahrenheit. Ibid.

Specification of a patent granted to Thomas Bonsor Crompton, *of Farnworth, county of Lancaster, for certain improvements in the manufacture of paper.*—[Sealed 6th April, 1839.]

This invention consists of a new method of producing a vacuum in the wire cylinder, or in the vacuum box under the wire cloth, over which the paper passes in the course of manufacture.

The patentee produces a vacuum by means of a number of rotary fans placed in connection with the vacuum box, and which being made to revolve at a considerable velocity, exhaust the air in a continuous current.

The water contained in the paper is extracted from it, as it passes over the wire cylinder or wire cloth, by means of the air which presses on the surface of the paper as it endeavours to fill up the vacuum formed below. The water thus extracted is drawn off from the vacuum box by a syphon.

The patentee states, that paper made in apparatus with his improvement

attached thereto, will be found to be more even and regular in thickness than that which is made in a machine where the vacuum is caused by the reciprocating motion of a pump;—the thickness of the paper being rendered irregular by the uneven pressure of the atmosphere on its surface, occasioned by the air being exhausted in puffs. Ibid.

Specification of a patent granted to WILLIAM JOYNSON, *of St. Mary Cray Paper Mills, Kent, for a certain improvement or improvements in the manufacture of paper.*—[Sealed February 21st, 1839.]

This patent is for a method of producing the water-mark, or maker's name, on paper. The method of effecting this may be thus explained:—

Projecting letters, figures, or devices, made of round or oval wire, are fixed to the dandy roller, which is a cylinder formed of an axle, having arms or rings projecting from it, and covered with wire cloth. The figures or letters are formed of wire, flattened on the side, by which they are attached to the roller, but having the upper side, or that which makes the indentation in the paper, of a round form.

The paper, in a pulpy state, being passed over this cylinder, is marked in those places that come into contact with the projecting devices, and form what is generally known as the water-mark. Ibid.

Specification of a patent granted to ALPHONSE RENE LE MIRE DE NORMANDY, *of the city of London, for certain improvements in the manufacture of inks and dyes.*—[Sealed 1st August, 1839.]

In the specification of this patent there are five distinct improvements or methods of obtaining inks and dyes, applicable to dyeing, staining, and writing.

The first improvement is for a method of superseding the use of nut-galls, and of correcting the green and brown precipitates obtained from combination of gallic acid and sulphate of iron, as in the manufacture of the common black inks now in use.

Secondly, for a method of treating campechy wood, (Hæmatoxylon Campechiacum,) for the purpose of obtaining a beautiful purple colour, called by the patentee, the "King of Purples."

The third improvement is for a method of rendering Chinese blue, or cyanoferruret of iron, soluble, so as to render it applicable to the manufacture of inks and dyes.

The fourth improvement is for the production of a solid or semi-solid soluble ink, which being in a solid form, may be easily rendered fit for use, as a writing ink, by adding a sufficient quantity of liquid.

The fifth and last improvement consists in combining carbon with certain acids for the production of a really indelible ink, which cannot be effaced by any chemical agent.

For the first improvement, instead of using nut-galls, the gallic acid is obtained from sumac, elm wood, chesnut, beech, willow, poplar, catechu, cherry, plum, or any other wood or berry, that contains gallic acid, or tannin, or both. The wood to be used, being first reduced to powder, is steeped in water, and combined with the hereinafter named substances, in about the following proportions. It is here observed, however, that the va-

rious woods require different quantities of water, according to their solubility; for instance, catechu, being nearly entirely soluble in water, will require a greater quantity than sumac; the patentee has therefore only given the proportions to be observed when sumac is used.

To make 340 gallons of ink, take from 12 to 15 sacks of sumac, of four bushels in the sack, and having obtained the decoction, add 200 weight of campechy; 80 lbs. or perhaps 100, weight of gum arabic; 100 weight of sulphate of protoxide of iron; acetate and hydrate of protoxide of copper, 4 lbs.; sulphate of alumine and potash, 37 lbs.; and of sulphate of indigo, 6 lbs.;—the quantity of this latter may be regulated according to the required intensity of the colour. If catechu is employed, then 100 weight will be found sufficient.

To produce a purple colour, called the "King of Purples," the following proportions must be observed:—To 12 lbs. of campechy wood add as many gallons of boiling water; pour the solution through a funnel, with a strainer made of coarse flannel, on to 1 lb. of hydrate or acetate of deutoxide of copper, finely pulverized, (at the bottom of the funnel a piece of sponge is placed;) then add immediately 14 lbs. of sulphate of alumine and potash, and for every 340 gallons of liquid add 80 lbs. of gum arabic or gum Senegal.—Let these remain for three or four days, and a beautiful purple colour will be produced.

The third improvement consists in an improved method of operating upon Chinese blue or cyanoferruret of iron. The cyanoferruret of iron is to be ground in water with oxalic acid, or bi-oxalate of potash, adding gum arabic in the following proportions:—To 7 oz. of water add three drachms of Chinese blue, 1 drachm of oxalate of potash, and 1 drachm of gum arabic,—to these ingredients a solution of tin may be added.

To make a solid or semi-solid soluble ink, which constitutes the fourth head of the invention, salts of iron, of alumine and potash, of copper and indigo, catechu and hæmatoxylon, are mixed together in the following proportions:—3 drachms of catechu, 1 drachm of hæmatoxylon, 10 grs. of acetate of deutoxide of copper, 1 scruple of sulphate of alumine, 1 drachm of gum arabic, 1 drachm of sulphate of iron, and a variable quantity of indigo, —all of these materials must be mixed in a state of powder, and a strong solution of campechy added. All the ingredients should be well amalgamated to make a thick paste, which must be dryed in the open air or in a gentle temperature; and when dry, the paste may be cut into squares, diamonds, or any other shape, like lozenges. This mixture is intended to make the solid soluble ink; but to make it semi-solid, it is necessary to add 1 drachm of uncrystalizable sugar or molasses, for the purpose of preventing it from becoming hard.

The fifth and last improvement is for a method of combining carbon with other colours and acids for the purpose of producing a really indelible ink. To accomplish this object, the following proportions and directions must be attended to:—Grind 24 lbs. of carbon (Frankfort black is used in preference to any other) with a mucilage formed of 20 lbs. of gum to 60 gallons of water, and after filtering it through a flannel, add 4 lbs. of oxalic acid and a variable quantity of cochineal and sulphate of indigo.

The claims set forth by the patentee are as follow:—First, using sulphate of indigo with gallic acid for the purpose of correcting the green and brown precipitates, such gallic acid being obtained in the manner above described, from sumac, catechu, elm wood, and other substances containing gallic acid or tannin, and which have not hitherto been so employed;

secondly, for the method described of acting on campechy wood by means of acetate or hydrate of deutoxyde of copper with sulphate of alumine, for the purpose of producing a beautiful purple colour; thirdly, using the oxalic acid, or bi-oxalate of potash with a solution of tin to dissolve Chinese blue or cyanoferruret of iron; fourthly, combining catechu, hæmatoxylon, and sulphate of indigo, to produce a solid or semi-solid ink; and fifthly, combining oxalic acid with carbon, cochineal, and sulphate of indigo, to produce an indelible black ink, which cannot be defaced by any known chemical agent. Ibid.

Specification of a patent granted to JULIAN SKRINE, *of Cambridge, for an invention of certain improvements in manufacturing forks, spoons, coins, and medals.*—[Sealed April 30th, 1839.]

The object of this invention is an economical and expeditious method of manufacturing spoons, forks, coins, and medals. The method of carrying the invention into effect, may be thus explained:—

Pieces of metal of something like the shape of the articles to be produced, are in a heated state, passed between two rollers, having a pattern or ornamental device cut or engraved upon their peripheries. These rollers are called the preparing rollers, and are intended to give the required thickness to the different parts of the article, and also to stamp or impress the shape of the pattern or device thereon preparatory to their being passed through the finishing rollers, which are another pair of rollers having the pattern or device cut or engraved thereon, and are intended to complete the formation of the pattern or device given by the first pair or preparing rollers. The articles in this state are removed to a pair of dies for the purpose of straightening or giving them the shape required for spoons and forks. The articles may then be polished and finished up in the ordinary manner.

Coins and medals are produced by forming or preparing them in the first pair of rollers, so as to give, as it were, the outline or shape of the device,—the pattern or ornament being finished by the second pair or finishing rollers.

The patentee claims producing the various articles above-mentioned, by means of rollers having the pattern, ornament, or device cut or engraved on their peripheries. Ibid.

Specification of a patent granted to RICHARD LAMB, *of Southwark, in the county of Surry, for his invention of improvements in apparatus for supplying atmospheric air in the production of light and heat.*—[Sealed 15th March, 1839.]

In order to keep up a regular and constant blast to a lamp or fire, a quantity of atmospheric air is forced by a pump or other mechanical means into a reservoir, furnished with a stop-cock to regulate the supply. The air is expressed from the reservoir by means of a weight or other convenient power, and is conveyed by a pipe to a lamp, fire-place, furnace, or other situation where a blast may be required. By this means a constant and undeviating supply of air is obtained, instead of the sudden puffs given by a bellows of the ordinary construction. Ibid.

Specification of a patent granted to William Colchester, *of Ipswich, in the county of Suffolk, for an improved soap frame.*—[Sealed 29th July, 1839.]

The frames, usually employed in the manufacture of soap, are made of wood, bound with iron, for the purpose of strength. Wood, however, being a very bad conductor of heat, it generally requires from six to eight days to allow the soap to become sufficiently cool to be removed from the frame. Instead of wood, therefore, the patentee employs stone, slate, or marble, which being good conductors of heat, the soap, in frames made of these substances, will cool in a much shorter time,—24 hours being generally found long enough for the soap to become hard. Although other materials are mentioned, the patentee prefers slabs of slate, properly held together by ties.

Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

On the Galvanic Properties of the Metallic Elementary Bodies, with a description of a new Chemico-Mechanical Battery. By Alfred Smee, *Esq.*

Last May a number of experiments were performed upon the galvanic properties of the non-metallic elementary bodies, and these were attended with the acquisition of some curious information, but till lately no opportunity has presented itself of extending the series of investigations then conducted: now, however, that I believe that I can lay before the public a valuable battery, no time is lost, that others may extend and improve the new principle about to be detailed.

With regard to the metallic elementary bodies, their properties have been investigated so frequently, and to such an extent, that it may seem unnecessary to draw attention again to them; but two circumstances influencing their action have never been noticed. It is well known that the positive metal should be the most readily acted upon by the solution, and the negative the least, and the further these are apart, the more forcible will be the battery: thus, *cæteris paribus*, platina and zinc are more powerful than iron and zinc; but if a circuit be made of a piece of smooth platinum and zinc it will sometimes happen that the effect is less than when a circuit is formed by a similar piece of iron. Now this appears at first sight paradoxical, though it can in many instances be easily explained; for if the platinum be carefully examined, it will be seen that the acid solution does not really wet the platinum, but runs off from the greater part of the surface, as metallic mercury does from glass. In this state, a piece of platinum having a surface of thirty-two square inches, formed into a battery with amalgamated zinc and connected with a magnet, supported three-quarters of a pound through five thicknesses of paper; when the same piece of platinum was heated or dipped in nitric acid and afterwards well washed, it supported a similar weight through twelve thicknesses of paper, thus being less powerful than iron in the first instance, and more so in the second. In the same way, silver supported under the like circumstances, the keeper

of a magnet through three layers of paper: on being heated and again wetted, the attractive force was exerted through nine thicknesses of paper, but no additional power was gained by removing the surface of the silver by nitric acid. The metals in these cases appear to become coated with a film of air, which effectually prevents the contact of the fluid. This is also seen in the various forms of charcoal, which after ignition are very powerful, but lose much of their force if long exposed to the air; their energy however is restored upon their being again heated.

As in the experiments just detailed, and in those which I am about immediately to describe, the relative powers of the arrangements have to be considered, it will be proper to mention in what way the results were obtained. A soft iron horse-shoe magnet was suspended, round which covered wire in communication with the poles of the battery was wound: the keeper, which weighed three quarters of a pound, was separated from the poles of the magnet by as many layers of thin blotting paper as could be used without its falling; thus with a battery of feeble force few layers of paper could be interposed; but with one of greater strength, forty or sixty thicknesses might be used. A similar form of apparatus might easily be devised, which would show by means of a delicate screw the exact distance at which a given weight would be supported by the attractive force of the induced magnet.

The influence of different conditions of surfaces is a subject which has escaped all experimenters. Now this is singular, for many must have noticed, that in a circuit, the greatest quantity of gas is given off at the corners, edges, and points. Following this hint, a piece of spongy platinum, consisting as it does of an infinity of points, was placed in contact with amalgamated zinc, when a most violent action ensued, so that but little doubt could be entertained of its forming a very powerful battery. The fragile nature of this material precludes it from being thus used, and therefore it was determined that another piece of platinum should be coated with the finely-divided metal. This experiment was attended with a similar good result, and the energy of the metal thus coated was found to be surprising. To test the value of this process, a piece of platinum thus platinized, was placed in dilute acid in contact with amalgamated zinc, and the quantity of gas evolved in a given time was noticed.

Platinized platinum	7 sq. inches gave off	5	c. in.	per	1	minute.
Platinum heated	ditto	1	"	per	1	minute.
Platinum covered by air	ditto	1	"	per	6	minutes.
Platinized coke	small piece	3	"	per	5	minutes.
Plain coke	ditto	1	"	per	25	minutes.

In these experimentst he contact was made in each cell alike; the same zinc being used, and the distance being the same between the metals. The energy of the metal, thus prepared, upon the soft iron magnet is very great. A piece of platinum exposing thirty-two square inches of surface, supports three-quarters of a pound through seventeen thicknesses of paper, whilst when smooth and wetted it supported it through eleven layers; and when no care was taken about its being wet, but when simply plunged into the liquid, only through five layers of the same paper.

The cause of this increase of power appears to be the facility given to the evolution of the gas from the number of points, and not from an increase

of surface, as but little benefit attends its application in the nitric acid batteries, in which the hydrogen is not evolved, but absorbed by the fluid.

The next point which we have to consider, is whether other finely-divided metals have the same good effect; but no other of the many metals that I have tried can be used with similar good results, except palladium, which though it has not much effect in the sponge, is found when precipitated on platinum, or silver, to possess powers, about equal to the finely-divided platinum. Precipitated silver increases the power of the metals, but not nearly to the extent of platinum.

Having ascertained that a solution of platinum must be used for increasing the power of metals in their ordinary state, it becomes a matter of great importance to ascertain whether the platinum may be precipitated upon other metals with advantage; and for this purpose it was deposited upon earthenware, palladium, pure silver, copper plated with silver, nickel, German silver, tin, lead, brass, cast iron, sheet iron, steel, zinc, and charcoal. The platinized earthen ware was not found to answer, apparently from the quantity of the metal not being sufficient to carry the electricity. Palladium, silver, and plated silver answered equally well with platinum to receive the precipitated metal, and if there was any difference, I think the silver was rather the best. Plated copper answers very well, but care should be taken to varnish every copper edge, or else that metal is apt to be slightly dissolved, and deposited again upon the platinized silver, which is injurious. Should copper, from any cause, get upon the silver, it may be dissolved by a little muriatic acid, and afterwards by a little strong ammonia. No other metal or alloy besides this answered for the reception of the platinum, except iron, and this was as active as silver for a time, but then a local battery was formed between the platinum and iron—the iron was dissolved and the battery destroyed. In some cases this does not take place so rapidly as in others. Carbon answers admirably for the reception of the platinum, and is improved in like manner.

We have now the elements for the manufacture of a powerful battery; for we have seen that increase of power is obtained by taking care that the negative metal is thoroughly wetted by the fluid, and that this is not only accomplished, but its power materially increased by the numerous points formed by the precipitation of finely-divided platinum. Whatever metal, alloy, or compound may be found hereafter to succeed for the reception of the platinum, or whatever metal may be found to answer instead of the finely-divided platinum, still the principle by which the advantage is gained will be the same. However, the battery which I now propose is to be made of either copper plated with silver, silver, palladium, or platinum. The silver can be rolled to any thinness, and therefore is not expensive. Each piece of metal is to be placed in water, to which a little dilute sulphuric acid and nitro-muriate of platinum is to be added. A simple current is then to be formed by zinc placed in a porous tube with dilute acid; when, after the lapse of a short time, the metal will be coated with a fine black powder of metallic platinum. The trouble of this operation is most trifling; only requiring a little time after the arrangement of the apparatus, which takes even less than the description. The cost I find to be about 6*d.* a plate of 4 inches each way, or 32 square inches of surface. This finely-divided platinum does not adhere firmly to very smooth metals, but when they are rough is very lasting, and sticks so closely that it cannot be rubbed off. On this account, when either silver is employed, or copper coated with silver, the surface is to be made rough by brushing it over with a little strong nitric

acid, which gives it instantly a frosted appearance, and this, after being washed, is ready for the platinizing process.

With regard to the arrangement of the metal thus prepared great diversity exists; it may be arranged in the same way as an ordinary Wollaston's battery with advantage; a battery thus constructed possessing greater power than Professor Daniell's battery: 4 cells, containing 48 square inches in each cell, decomposed 7 cubic inches of mixed gas per five minutes, whilst four cells of Professor Daniell's, in which 65 square inches of copper were exposed in each cell, gave off only five cubic inches in the same time. However, in my battery thus arranged, the action dropped to 5 cubic inches in five minutes, but it resumed its power after the contact had been broken for a few seconds. This battery also possesses great heating powers, raising the temperature of a platinum or steel wire, 1 foot long and of a thickness similar to that used for ordinary bird-cages, to a heat that could not be borne by the finger.* Its magnetic power is not less astonishing, three cells supporting the keeper of a magnet through forty-five, two cells through thirty-two, and one cell through twenty thicknesses of paper. An electro-magnetic engine was made to rotate with great velocity, the combustion of the mercury at the breaking of contact being exceedingly brilliant.

A battery of this construction should be in every laboratory, to be used in most cases where a battery is wanted, and the slight labour attending its operation is scarcely worth mentioning. I have used one for 48 hours consecutively without the slightest alteration either of the fluid, or in the arrangement of the metals, and the diminution attending its operation appeared to arise from deficiency of acid, for it was instantly restored by a little strong sulphuric acid in each cell. Where the battery is required to possess the same power for a long period, it might be advisable to separate the metals by a porous earthenware vessel, or what answers the purpose equally well, by a thick paper-bag, the joinings of which must be effected by shell-lac dissolved in alcohol. By these means, the sulphate of zinc is retained on the zinc side of the battery. The use of porous tubes, however, appears from observation, as far as my battery is concerned, to be nearly superfluous, at any rate in most cases; for I find, that after a battery arranged as Wollaston's had been at work in the same fluid for forty-eight hours, it had no zinc deposited on the silver. It is worth remarking, that during the last 24 hours contact had not been broken for a single instant. Notwithstanding these experiments, however, it may be as well in an extensive battery to use porous plates.

The battery may be arranged like the pot batteries, but I should greatly prefer the troughs, such as are used for Wollaston's batteries, from the convenience of packing, and from a battery of the same surface requiring so small a space. A battery may be constructed to form a most powerful calorimotor. It may also be arranged as a circular disk battery. Or it may be made as a Cruickshank's, each cell being divided or not by a flat porous diaphragm. Whatever arrangement is adopted, the closer the zinc is brought to the platinized metal, the greater will be the power.

The generating fluid which is to be employed is water, with one-eighth of sulphuric acid by measure; and the zinc ought always to be amalgamated in the first instance, as that process will be found very economical from its

* A small pot battery of six cells fairly fused into globules two inches of iron wire, and the combustion of different metals was extremely brilliant, when the battery was in combination with a Bachoffner's apparatus.

stopping all local action, and the amalgamation will be found not to require repeating, because there is no fear of copper being thrown down on the zinc, which occasionally happens in the sulphate of copper batteries.

The battery thus constructed is the cheapest and least troublesome in action that has ever been proposed, and from the smallness of its bulk will be found very valuable to electro-magneticians. It is second in power only to the nitric acid batteries, the objections to which have been already noticed. For medical purposes, with a Bachoffner's apparatus, a battery composed of platinized silver two inches each way will be found sufficient.

To recapitulate the processes of the formation of a battery: first the platina, silver, or plated copper must be roughened, the two latter with nitric acid, and afterwards washed. The metal is next to be placed in an acid solution with a little nitro-muriate of platinum, which metal is to be thrown down by the formation of a simple galvanic circuit; and lastly, the platinized metal is to be formed with amalgamated zinc into a battery, either with a porous tube or paper-bag, or without them, according to the fancy of the operator, or the purpose for which it is wanted.

The advantage from this form of battery arises, as I believe, from a mechanical help to the evolution of the hydrogen; and therefore it is proposed to call it the Chemico-mechanical battery. This battery may remain in the acid for a length of time, and neither the amalgamated zinc nor platinized silver will undergo the slightest change, and the whole will be as silent as death. Let only communication be made, the liquid in each cell becomes troubled;—it boils—it bubbles, and produces the effects which have been detailed. The quantity of electricity passing through either wires or liquids may be pretty accurately judged from the action taking place in the battery, for if the communication be made through a liquid of difficult decomposition, or through long small wires (70 or 80 feet,) but little gas will be given off from the platanized metal, but when short thick wires are used the action is violent. A galvanometer might be constructed of one cell, similar to the oxygen cell of Professor Daniell, as this would show the exact amount of electricity passing.

The constructing a battery that shall be small in compass, efficient in action, cheap in its operation, and devoid of troublesome manipulation, is important in the highest degree; and I consider that my chemico-mechanical battery will be found frequently a useful means of obtaining gases for the oxy-hydrogen light. Its value for blowing up vessels under water, and exploding powder in mines, is sufficiently obvious.

In conducting the extensive series of experiments, of which this is a summary, the grand features have been rather attended to than very minute results; and in conclusion, it would ill befit me if I did not here mention the valuable assistance I have received by the loan of apparatus, &c. from many individulals, but most especially from professor Daniell, William Terry, Esq., and Mr. E. Hart Palmer. Lond. & Ed. Philos. Mag.

Experiments on Mechanical Exosmose. By Julius Jeffreys, *M. R. C. S. late of the Hon. East India Company's Bengal Medical Service.*

A class of vitrifiable mixtures may have a body chiefly aluminous; and one of these combined with a felspatic earth and a small proportion of iron

oxide, produced the ware which *yielded* the experiments. This ware underwent, from a dull red up to the time it was at a full white heat, a regular progressive contraction of its parts, by which time it had lost one fourth or one fifth in length. Commencing with pores so open that they would transmit water or gas with little resistance, it became at the heat of fused cast iron as close and dense in texture as glass; and when cooled, was equally impermeable by fluids under any pressure, exerted during any length of time.

Such a substance in its passage through every intermediate degree of density, from that at which all fluids were allowed to pass through it, to that at which they were all confined, might be expected to arrive at some one, at which it would detect any difference in the size of the molecules of two fluids pressing against it for passage, by detaining the one but transmitting the other.

The results were curious. Vessels formed of this composition thick enough to bear the pressure within, were filled with water, containing a small quantity of mineral alkali, and into which was condensed about twelve times its bulk of carbonic acid gas under a pressure of nearly eight atmospheres; their mouths being effectually secured so that no leakage whatever took place through them. The alkali varied from half a drachm to a drachm and a half of carbonate in twenty ounces. Such vessels as were in their most porous state, having been only hardened at a full red heat, allowed both the water and the gas to be ejected by the repulsive force through their pores, the liquid being projected in every direction in the form of a fine rain or cloud, until the pressure within was relieved.

Such vessels again as were in a properly effective condition, having been exposed to their maturing heat, retained their contents without any apparent loss for a year; and when placed near a fire would burst with a violent explosion, without allowing any exudation to take place.

A third kind of the same composition, apparently intermediate as to density between the two already noticed, allowed the gas alone to make its escape through the pores, rather quickly at first, but as the pressure lessened more gradually, until an equilibrium was nearly established, the whole or nearly the whole of the liquid being retained.

In a fourth kind a density was attained much above the last, but short of that of the entire impermeability of the second kind described, and this texture yielded results very curious in themselves, and especially so when contrasted with those last described. Here instead of the gas escaping, and the liquid being retained, the reverse took place. In process of time, varying from two to four months, every drop of the water was forced out, so that when the vessel was opened it was as dry within as when it came out of the furnace; yet the gas was retained highly condensed, and made its escape with a loud report.

On one occasion a violent explosion took place from a blow which I had reason to suppose would not have been sufficient to cause it, had alkaline solution been present to restrain the elasticity of the gas. In one case the outer surface of the ware was frosted over with the efflorescent alkaline carbonate, which had passed through it in a state of solution: the water was all gone, the vessel being as before perfectly dry within, yet the gas apparently all present.

The power that effected the transmission of the water and alkali being the elastic force of the gas, I could conceive it to act in no other way than mechanically, and to indicate, therefore, some difference in the size of the

lastic and the liquid molecules; the former being too large to find passage ırough the pores of this closer ware, while the latter, both aqueous and kaline, all escaped. So far the gaseous were heterogeneous to the liquid ırticles; and the difference of size indicated might be supposed to depend pon a difference of their original magnitude, and not of magnitude arising om their liquid and gaseous condition. But it will be observed that the kaline *carbonate* traveled out with the water. Here, therefore, was carbonic acid in a liquid state, forced out through apertures which refused exit the same matter in the state of gas. By this it would appear that the toms of matter are indeed invested, as has been supposed, with an ethereal mosphere elastic in itself, but forcibly drawn around the atom, so that it ın find passage only where there is space for its ether to accompany it, 1d that this ethereal investment being much larger around gaseous than round liquid particles, apertures through which the latter may be forced ıay nevertheless be too small for the passage of the former. It appears me difficult otherwise to explain the phenomena of this experiment.

Again, in that case in which the reverse took place, namely, an exit of ıe *gas* and a retention of the *liquid*, and which was a result most persons ould expect, inasmuch as it is commonly more easy to make vessels watergħt than air-tight, a sufficient explanation may be given which shall not be ıcompatible with the case just recorded, and which may remove the appaənt incongruity of the two experiments In this case, though the pores ere free enough to give passage both to the water and to the gas, the density as still sufficient to detain the water during the time the gas kept extricatıg itself, and constantly occupying the pores of the ware to the exclusion om them of the water. Though the chief force, the mechanical one, acted pon both fluids, a little might turn the scale in favour of the relief taking lace by a departure of the one and not of the other. Now quite enough decide the point in favour of the exit of the gas, might be found in the ell-established diffusive tendency of the gases shown in the phenomena f electric exosmose, by which the gas on the one hand would seek a dearture into the atmosphere through the ware, while on the other hand the ɔhesion of the liquid particles would favor their remaining together within it. his process went on until the gas was nearly all discharged, the small reıaining quantity being detained by the affinity of the alkali and the water.

In the instance of great porosity first noticed, the results explain themɜlves at once. Here there was not closeness of texture sufficient for even ıch a detention of the contents as would enable the gas and liquid to part, ıd the process of exosmose to remove the former; but both fluids were ropelled through the pores, the water in fine rain which formed into a ıist.

The familiar fact that water may be retained in a porous earthen pitcher ır a length of time without any escaping except by evaporation, although ıe lower part is under the pressure of a foot or more of the fluid, while ıch a pressure would suffice to force air quickly through the pores, would ɔmmonly be explained by supposing a greater minuteness of parts in the ıse of air than of water; but the above experiments would prove the conrary.

Ibid.

On Engraving by Voltaic Electricity. By Thomas Spencer.

In last week's *Athenæum* you made some remarks respecting my invention f engraving by voltaic electricity. I need scarcely say I feel much grati-

fied to know it is becoming generally useful, although I have had much more striking proofs of this than you seem to have yet seen. My object in now addressing you, is to lay before your readers some improvements I have recently made in the process, which, although apparently trifling in themselves, will be of immense importance in its future applicability. I am the more induced to do this through the medium of your journal, as I have a greater number of correspondents requesting information on the subject than I can readily answer, and finding most, or all of them, are your readers, this may suffice.

In my pamphlet, published last September, I gave some directions how to construct the necessary apparatus. I then recommended plaster of Paris as a medium to separate the cells. Since that time I have tried many other porous substances; but find that brown paper far exceeds everything else that I have hitherto used. The advantages derived from its use are, that it will allow a deposit to take place in one-half the time that would be occupied in depositing a given thickness by the use of plaster of Paris—the metal deposited being of a very superior character; and the whole operation proceeds with a degree of regularity I have not experienced in the use of anything else. The paper I use is not the brown paper usually sold by stationers, but a thicker sort, manufactured, I apprehend, by the paper-makers to inclose their parcels in. I fasten it to the interior cell of the apparatus by melted pitch, or the common resinous cement used by philosophical instrument makers. The zinc in the interior cell should rest at $\frac{1}{8}$th of an inch distance from the brown paper, and the plate to be deposited on should be kept at about $\frac{5}{8}$ths or $\frac{3}{4}$ths of an inch from the opposing paper surface in the exterior cell.

I also previously recommended a cement of which those portions of a plate *not* to be deposited on, were to have a coating; I now find, however, that common bees-wax, melted by heating the plate, entirely prevents deposition on those parts to which it is applied. Every thing hitherto used by me allowed partial deposition to take place. If the solution can be kept at a temperature of 80 or 90° Fahrenheit, the process is accelerated—this is much better than quickening it by the addition of the salt used to excite the positive cell.

A writer in the *Philosophical Magazine* recommends that the plates might be more conveniently suspended by being placed in the apparatus vertically. A little experience, however, will prove this to be a disadvantage; as, in such cases, the deposition at the lower end will greatly exceed that at the top, consequently rendering the plates very much thicker at one end than the other, which is to be avoided.

In a previous number of the same journal, Prof. Jacobi recommends that a galvanometer be always placed in connexion with the apparatus. This is sheer absurdity, tending needlessly to complicate, without affording the slightest clue to what is taking place in the cells—it pointing out the development of feeble quantity, not intensity; and the slightest variation in the size of the plates, or their distance from each other, would give contrary results.

I am now occupied in some experiments which may terminate in still greater improvements in the economical use of this principle. While I write I have before me a small electro-magnetic rotary machine in rapid motion. In connexion with it there is a helix, or coil, of covered copper wire, consisting of two lengths, each 400 feet, the thicker one transmitting the primary current, the smaller the induced current. In connexion with one

end of the primary wire I have placed a copper plate to be copied—to the opposite end of the same wire I have connected a spiral of *copper wire*, which is immersed in a porous cell containing dilute sulphuric acid, with a few drops of nitric acid, the plate to be copied being immersed in sulphate of copper: the electric action excited by this arrangement being sufficient to revolve the magnetic machine—*while, at the same time, it is depositing* pure copper on the plate to be copied, in one cell, and *producing* sulphate of copper by the dissolution of the copper wire in the other. To each end of the smaller wire transmitting the induced current, I have also attached a similar arrangement—viz. a plate to be copied, and a piece of spiral wire, in a pair of separate cells. This arrangement *is also* depositing copper on the plate to be copied. My object in this was to take advantage of the increased amount of electric action always acquired by transmitting the current through spiral coils, and also to avail myself of the induced current, which is always eliminated in an opposite direction to the primary. This latter current is generated at absolutely *no* expenditure of material. For the mere purpose of depositing copper, I might have used the helix without the rotary magnet; but my object was to ascertain the practicability of *employing* the electricity generated by the process for other uses. From this experiment I can give my opinion without hesitation, that should electro-magnetic engines be brought into practical use, of which I entertain no doubt, the same battery that excites them into action on the one hand, will, on the other copy engravings of any size, *ad infinitum.* For, after all we have heard lately of voltaic batteries of intense power, sustaining ones, slow but equable, are the only apparatus that can be depended on for an indefinite length of time. I have not yet made experiments with the helix in sufficient number to warrant me in stating, for the present, the increase of deposition that may be derived from its use. I intend trying a number of statical experiments with coils of different thickness, and also coils of flat copper rolled up in the form of ribbon, covered with silk. The results of these may form the subject of another communication.

Liverpool, April 14. Athenæum.

New Voltaic Battery.

A few evenings ago, a Voltaic Battery, upon a new and improved construction, was exhibited at a meeting of the Members of the Society of Arts, and gave great satisfaction. It is the invention of Alfred Smee, Esq. and constructed by Mr. Palmer, of Newgate street.

The inventor calls it a "Chemico Mechanical Battery," and the peculiarity of construction consists in coating the negative plate with a layer of finely divided platinum, which not only insures perfect contact with the exciting liquid, but from the immense number of points which it presents, causes the most violent and intense action, which however ceases immediately the circuit becomes broken. It excited very great interest, and is well worthy the attention of gentlemen interested in this branch of science.

The advantages of this new battery are so very great, that it must, we should imagine, supersede all other constructions at present known. Instead of the trouble and inconvenience arising from the use of solutions of sulphate of copper and muriate of soda, as in the batteries now in use, it requires only one sort of exciting liquid, and that of the cheapest and cleanest kind, namely,—dilute sulphuric acid, mixed in the proportions of

one part by weight of acid to eight of water; the battery does not require any trouble to keep in order, for when the apparatus is done with, it only requires to be taken out of the liquid, and is always ready for use, at any period, however distant. Through the kindness of Mr. Palmer, we have had an opportunity of witnessing the surprising effects of this battery.—It consists of 24 pairs of small plates, and an earthenware trough for holding the acid solution. Platinum wire, the least fusible of metals, is not only heated to a white heat, but completely and instantaneously fused. Iron wire, of considerable substance, is also instantly melted, and falls down in globules; but the most brilliant effects are produced by connecting the battery to an electro magnetic apparatus, when the combustion of different metals resembles a display of fire-works.

Upon connecting two pieces of coke, or charcoal, one to the positive and the other to the negative end of the battery, and bringing them into contact, a light nearly if not quite equal in intensity to the oxy-hydrogen light, is produced.

A great advantage to be derived from the use of this battery, is its economy, as after the first outlay incurred in purchasing the article, the cost of setting it in full action is not worth attention; the only exciting liquid being, as before mentioned, diluted sulphuric acid; and from the greater degree of power exerted by this battery, it will not be necessary, under ordinary circumstances, to have so large a one as must be employed for similar purposes, if one constructed in the ordinary manner be used.

We are informed, that a small one, consisting of only one pair of plates, and which may be used in a common drinking tumbler, will be found sufficient for general medical purposes, and for connexion with an electro magnetic apparatus.—The cost of such battery would not exceed ten shillings.

Lond. Jour. Arts & Sci.

Sawn Slate Pavement.

Experiments have been made to ascertain the applicability of slate to other uses than the covering of houses. The result has been the discovery that, as a material for paving the floors of warehouses, barns, &c., where great strength and durability are required, it is far superior to any known material. In the extensive warehouses of the London Docks it has been used on a large scale. The stones forming several of the old floors having become broken and decayed, have been replaced with slate two inches thick; and one wooden floor, which otherwise must have been relaid, has been cased with slate one inch thick, and the whole have been found to answer very completely. The trucks used in removing the heaviest weights are worked with fewer hands. The slabs being sawn, and cemented closely together as they are laid down, unite so perfectly that the molasses, oil, turpentine, or other commodity which is spilt upon the floor, is all saved; and as slate is non-absorbent, it is so easily cleaned, and dries so soon, that a floor upon which sugar in a moist condition has been placed, may be ready for the reception of the most delicate goods in a few hours. Wagons, or carts, containing four or five tons of goods, pass over truck-ways of two-inch slate without making the slightest impression. In no one instance has it been found that a floor made of sawn slate has given way; in point of durability, therefore, it may be considered superior to every other commodity applied to such uses. The consequences of this discovery have been, that full em-

ployment is found in the quarries which produce the slate, and that additional employment has been given to the British shipping engaged in the coasting trade. Mining Journal.

Voltaic Reaction.

A Lecture was given by Mr. Grove on voltaic reaction, or the phenomena usually called polarization.

Mr. Grove detailed the first experiments of Volta, Erman, Ritter, and Davy, the more recent ones of De la Rive, the explanation of these by Becquerel, and the confirmation of this latter philosopher's opinion by the experiments of Dr. Schœnbein, Mr. Matteucci, and Mr. Grove himself; all which, as well as the experiments of Mr. Grove on the inactivity of amalgamated zinc, which he proved to be due to the same order of causes, have been already given in full in various numbers of the Philosophical Magazine. All the effects which have generally been included under the term polarization were proved by Mr. Grove to be traceable to one principle, viz. the electrolytic transfer of elements having for each other a chemical affinity, and the reaction caused by this affinity when the decomposing and transferring power, i. e. the initial voltaic current, is arrested. What we are most anxious to call the attention of our readers to, are the astonishing effects exhibited by Mr. Grove at the conclusion of his lecture. Two batteries, little differing in construction from that described by him in the Lond. and Edinb. Phil. Mag., were charged some time previously to the lecture, and up to the period of its conclusion remained in perfect inactivity until the circuit was completed. One of these was arranged as a series of five plates, and contained altogether about four square feet of platina foil; with this the mixed gases were liberated from water at the surprising rate of one hundred and ten cubic inches per minute. A sheet of platinum, one inch wide by twelve long, was heated in the open air through its whole extent, and the usual class of effects produced in corresponding proportion. With the other arrangement, consisting of fifty plates of two inches by four, arranged in single series, a voluminous flame of one inch and a quarter long was exhibited by charcoal points, which showed beautifully the magnetic properties of the voltaic arc, as Dr. Faraday held a piece of iron near it, being attracted and repelled by different portions of the iron: bars of different metals were instantly run into globules and dissipated in oxide. It should be borne in mind that all these effects were produced by a battery which did not cover a space of sixteen inches square, and was only four inches high, and which had been charged for some hours.

Mr. Grove adverted to the letter of Prof. Jacobi to Dr. Faraday published in the Lond. and Edinb. Phil. Mag., vol. xv. p. 161, and stated that Mr. Pattison, who navigated the Neva with Prof. Jacobi in October last, had observed that the batteries employed were on Mr. Grove's construction, which the Prof. without hesitation admitted. Lond. & Ed. Phil Mag.

Gilbert's improved Gas Stove.

At the Bath Instruction Society last week, the Principal, Edward Osler, Esq., late of Falmouth, delivered a lecture to the Associates on the different methods of warming and ventilating buildings, in the course of which he called their attention to a gas stove, on a new and improved principle, which has just been fixed in the school-room of the City Commercial School.

The common gas stove is merely a covered cylinder of iron, containing a hollow ring communicating with the gas pipe, and pierced with minute holes, from which the gas burns in small jets. The products of the combustion, mixed with a portion of gas, (for the gas is never wholly consumed when burnt in a jet) are discharged into the room, the air of which is thus rendered very unpleasant, and even unwholesome; hence the use of these stoves is confined to halls and shops where there is a very free ventilation. In the improved gas stoves these evils are entirely avoided. The gas is first mixed with a sufficient portion of atmospheric air to ensure its complete combustion and then passes through a plate of wire gause, on the surface of which it burns with a flickering blue flame. The combustion takes place within an oblong iron box, which is thus heated sufficiently to diffuse a soft and equable warmth through the apartment. A pipe carries off the vapour into the chimney. No inconvenience or risk whatever is connected with the use of the stoves, and the fire can be lighted or extinguished with the same facility as a common burner. This consideration, with the perfect freedom from dust and the avoiding of all trouble in keeping up the fire, makes the stove particularly desirable for a school-room. It also promises to afford an easy, cheap, and effectual means of warming a conservatory or hot-house; and it may be conveniently introduced into dwellings, for in addition to its use in warming the apartments, it may be employed, to a considerable extent, for cooking. The stove fixed in the Bath City School was made by the inventor, Mr. Edward Gilbert, Civil Engineer, &c. of Falmouth, and was exhibited last month at the annual exhibition of the Royal Polytechnic Society of Cornwall. Any person wishing to see it may be gratified by calling at the school-room. Bath Chronicle.

New Alloys of Metals.

A curious and valuable discovery has just been made in the alloy of metals. A manufacturer of Paris has invented a composition, much less oxidable than silver, and which will not melt at less than a heat treble that which silver will bear; the cost of it is less than 4*d.* an ounce. Another improvement is in steel; an Englishman at Brussels has discovered a mode of casting iron so that it flows from the furnace pure steel, better than the best cast-steel in England, and almost equal to that which has undergone the process of beating. The cost of this steel is only a farthing per pound greater than that of cast iron. Mining Jour.

Progress of Civil Engineering.

Habitudes of Iron. Asiatic Society. March 7.

H. Wilkinson, Esq., said, that he was about to read a paper on Iron: a subject which did not appear to have much connexion with the Society's pursuits; but when he stated that India could produce a metal equal in quality to the best iron from Sweden, and at a cost, when landed in England, of 60 per cent. under Swedish iron, he thought that anything on the subject would be received with interest. He said that Mr. Heath had received some hundreds of tons of ore from India, and he expected as much more, which contained 72 per cent. of pure metal; and from this ore excellent

wrought iron could be made at once. He had been performing some experiments on this iron in conjunction with Mr. Heath; and had made sword blades of the steel produced from it, which excelled any he had ever seen. Mr. Wilkinson said, that what he was going to read would not be absolutely new, though probably it might be to several gentlemen present. It was upon the spontaneous heating of cast iron when brought into the air after it had been for many years under salt water. Several instances of this action were stated; the most curious of which was that of some cannon balls, raised in June, 1836, by means of the diving apparatus, from the ship *Mary Rose*, which sunk in a naval engagement near the Isle of Wight, in July, 1545, nearly 300 years before. These balls all became hot on exposure to the air, and fell to pieces. It was observed, also, that they had all lost about 36 per cent. of their weight. An iron ring, from one of the guns, was placed upon the table; being of wrought iron, it had not exhibited the phenomena shown by the cast iron, and was merely oxidized. Mr. Wilkinson stated, the cast iron grating which had been long immersed in the porter vats in the large breweries of London, grew hot, when the porter was drawn off, and from a similar cause. He then alluded to the cast iron protectors which had been fixed to the copper bottoms of ships, so as to prevent their corrosion by salt water, in pursuance of a suggestion by Sir Humphrey Davy, and observed, that in this case the action of the salt water on the iron was greatly aided by the galvanic action caused by the contact of the two metals. The iron lost half its weight in two or three years, although retaining its original form; and in one large piece, which he produced, the weight was reduced almost to the levity of a piece of cork; and this piece would make a mark on paper like a lump of black lead. The cause of the action in all these cases was, the minute quantity of carbonic acid gas held in solution by the water, it being taken up with the atmospheric air, which was always found to contain about 1 per cent. of this gas. This acid was the cause of rust, which he proved by exhibiting two bottles, one containing iron in ordinary water, the other, iron in water deprived of its carbonic acid gas. In this bottle the iron was perfectly bright, notwithstanding it had been two years immersed; while in the other bottle the metal was covered with rust. These facts gave a clue to the cause of the curious phenomenon first mentioned. It was well known to chemists that several metals, when reduced to a minute state of division, caught fire spontaneously by the absorption of oxygen. Cast iron, which had been long exposed to the action of salt water, was in this state: it was, in fact, almost all carbon; and the little metal that remained, being diffused throughout the mass, was, necessarily, very minutely divided; on exposure to the air, an absorption of oxygen took place, and great heat was evolved. The subject might be illustrated by enclosing tartrate of lead in a glass tube, driving off the acid at a red heat, and then hermetically sealing the tube. The enclosed substance would be a black powder, consisting of lead minutely divided, combined with a small portion of carbon. This, if well made, would keep good for months; and on breaking the tube would instantly take fire. Mr. Wilkinson observed, that it was difficult to hit the mark correctly in this experiment, for the least access of heat agglutinated the lead, while, unless a certain degree was kept up, no lead would be reduced to the metallic state; and, in either case, spontaneous combustion would not follow. He had brought three or four tubes with him for exhibition; but had no great confidence that he should succeed in firing them. The tubes were broken, but the substance did not take fire: it appeared that the metal had not been suf-

ficiently reduced. Mr. Wilkinson therefore applied a small addition of heat, and the powder instantly inflamed on being shaken from the tube, and brought in contact with the air. Athenæum.

Burning Coal Mines.

In our last number we gave extracts from letters received of the progressive conflagration of the coal mines in the department of the Allier, which, since the year 1816, had not been subjected to so direful a result as that embodied in the following description, extracted from the *Athenæum.* The late accounts, however, state that considerable progress was being made in turning the waters of the river Gange into the workings, and thus stopping the progress of destruction. The loss, however, must, in any case, be considerable:—

"Letters and papers from the department of the Allier, bring accounts of a remarkable conflagration which lately broke out in the coal mines of Commentry, and had been burning for a week with daily increasing fury. It appears that this fire, which, for the last twenty-four years, has been silently smouldering in the bowels of the earth—revealing its existence by perpetual smoke, and occasional outbreaks of flame, which, however, had always been confined within the limits abandoned to its dominion—had, at length made its way through some breach into one of the vast galleries of these extensive workings; and there, meeting with the air-current so long denied it, had spread through all the subterranean chambers and passages with a rapidity before which resistance became utterly powerless, showing itself at every crevice and outlet of the vast labyrinth, and flinging its points and columns of fire far up into the air, through all the shafts that led into the wide field of the rich deposit. Luckily the solemnities of the day, it being Sunday, had emptied the workings of their human tenants, for no mortal aid could have availed them against the suddenness with which the fiery flood swept over all things. The authorities of the district were early on the spot, but have hitherto been little more than idle and awe-struck spectators. Neither Vesuvius, nor any other eruption, say the accounts, can give a notion of the dreadful and sublime scene. 'If,' says one writer, 'it were possible to forget that the flames have been, for three whole days, devouring immense wealth, and that by this conflagration 300 fathers of families will be thrown out of employment, there would be room for no other sentiment than that of admiration at the magnificent spectacle. Imagine a deep ravine, nearly circular, in the form of a reversed cone, with its edges, however, hourly enlarging. Through fourteen large openings, issuing at about twenty feet above the ground of this ravine, and giving access to the innumerable galleries of the mines below, as many torrents of flame are poured forth, with frightful violence from the cauldrons within—flames of a thousand hues rushing forth like fiery whirlwinds—dividing, and crossing, and mingling and rising, and falling, and rising again! At times, a hollow cracking sound echoes through the abyss; this is some huge block of coal detaching itself from the roof or sides of one of the galleries, and falling into the blazing gulf. Then rises up a thick column of black dust, till it reaches the openings of the galleries, where, pierced in all directions by the flames, long serpents of fire work through its volume from side to side.—Sixty feet higher up, on each side of the galleries, two gaping mouths shoot into the air their dazzling columns of fire. Suddenly one of these ceases.

It seems for a moment as if checked in its wrath. Then comes a long and startling groan from the entrails of the earth; and forth again rushes the flame, blood-red, roaring and terrible, threatening in its fury to lift up the burning mountain altogether, and bury the spectators beneath its dreadful ruins. Again, look around you; it is midnight, and 2000 human faces are there, some grouped on the opposite crest of the ravine, and some sheltered in the cavities of the rocks. Yet no sound meets the ear, save that of the roaring flames.' The latest accounts state that the rafters of the galleries had all fallen, and the founts of flame nearly ceased to play. The whole had become one huge burning gulf. The loss is said to be incalculable; millions of hectolitres of coal had been consumed. The engineers were preparing to turn the course of a stream, which flows at a league's distance, and direct it upon the burning mountain. Workmen were employed night and day in the operation, by which it was hoped to lay the mines under water."

A later account states "that the river flowed 38 metres beneath the coal-field. A minute survey of the ground was, however, made, and established the possibility of turning the course of a tributary stream, which flowed at a distance of 4,300 metres. The work was instantly commenced; the ground-formations for the bed of the deviation occupied 48 hours; and twice that interval of time sufficed to execute and arrange in their places certain wooden conduits, destined to traverse several intervening hollows. At length the waters so impatiently expected arrived, pouring into the burning mine 2,000 cubic metres of water per day. At the present moment, all the subterranean works are under water; and since the commencement of this month a system of irrigation has been established on the burning mass, which has produced the happiest effects. Hopes are entertained that, in time, not only will the immediate conflagration be extinguished, but that also which has been in operation for 24 years past." Mining Jour.

A New and Effectual Method to Kyanise Timber.

Within the last two or three weeks the Manchester and Birmingham Railway Company have commenced Kyanising their wood sleepers in a much more quick and effectual manner than by the old mode of simply depositing the timber immersed in the prepared liquid. The company have had made a large iron cylindrical vessel, weighing about ten tons, and which is about thirty feet long, and six or seven feet diameter, made from wrought iron plates, five-eighths thick, and double riveted, which vessel is capable of resisting a pressure of 250 lbs. on the inch. The vessel being filled as compactly as possible with wood sleepers, twelve inches broad and seven inches thick, the liquid is then forced in with one of Bramah's hydraulic pumps, and worked by six men to a pressure of 170 lbs. on the inch. By this means the timber is completely saturated throughout in about ten hours, which operation, on the old system, took some months to effect.

Observer.

Mechanics' Register.

Expanding Mandrel.

The Society of Arts have awarded their large silver medal to Mr. J. Hick, jun., of Bolton, for an improved expanding mandrel for turning lathes.

It is necessary that a mandrel should fit so accurately, as to bite on the inner surface with a force sufficient to counteract that of the tool, and, in the ordinary mode, the same mandrel cannot be used for two pieces which are of different diameters. Consequently, in many engineering establishments, a stock of mandrels is kept, amounting to 600 or 700. Mr. Hick purposes to do the same work with eight sizes of the mandrel, from one inch and a quarter to ten inches. He effects his object by having the spindle of the mandrel shaped on the frustrum of a cone, on the face of which are four dove-tail grooves to receive wedges, the under faces of which have the reverse inclination of the cone, so that the lines of their outside faces are always parallel with the axes of the mandrel. A nut is screwed on the spindle, which acts on the wedges through the medium of a conical cup, which drives them up to their bearings inside of the work. Mech. Mag.

Manchester and Liverpool Plate Glass Company.

A general meeting of the shareholders of this company was held on Friday, the 28th ult., at the works, Sutton, near St. Helen's. These extensive works are now in full operation, and the shareholders were gratified by viewing the various processes of the manufacture. Six large plates of glass were cast in a surprisingly short space of time, and, apparently, with great skill; indeed, the competition of the new and old companies seems likely to lead to considerable improvements in the production of this beautiful commodity. Upon this occasion, amongst a great number of very large plates of glass, there was shown one plate of a size that, we understand, has been rarely equalled in this or any other country; it was thirteen feet long by eight feet wide, and apparently free from imperfections.

Mining Journal.

Railways—Important Invention.

We copy the following paragraph from the *Sheffield Iris*, and, at the request of a correspondent, append a letter which has since been addressed to the editor of that paper, having reference to the invention.

"We understand there will be placed upon this railway, in a few days, an engine patented by a gentleman of this town, which possesses many advantages over any other. All the six wheels are connected by a strap either of hemp or leather, thereby presenting six points of adhesion or friction to the rails, instead of two, which will secure a uniformity of speed in all weather. It is expected to move double the weight, at the same velocity, to any other engine of same weight and capacity of cylinder. It will also greatly diminish the expenses of repairing the road; for each of the engines now in use weighs, when the boiler is charged with water, twelve tons, nearly the whole of which to ensure progressive motion, is placed upon the two driving wheels. But the patent engine having the weight divided equally between each wheel (every one being a driver,) it is obvious that the one engine is striking the rail with a twelve ton hammer, while the other is gently tapping it with four. Not only great speed, but great regularity also, are expected from railways, both of which will be insured by this invention. It will also acquire its speed, and be stopped, sooner than the other engine." Ibid.

Railways in England.

There are now in England 682½ miles of railway completed and in operation, and it is expected that in the course of the present year 630½ miles additional will be completed, making altogether 1313 miles of railway, which will be brought into operation before the end of 1840. There will then remain for subsequent completion in England 413 miles, the entire number of miles for which railway Acts have been passed being 1726 miles. The amount to be raised by calls for railway purposes during the present year is calculated to be 5,908,500*l.*, a sum considerably less than was called up during the past year of depression and suffering. The amount remaining to be called for, after 1840, is 3,865,000*l.*, which will complete the capital authorised to be raised for railways in England by Acts of Parliament passed up to the close of last session. Ib.

The "Archimedes."

We have of late heard frequent inquiries made respecting the important substitution of the screw for paddles, exhibited in the *Archimedes*, of which we gave an account several months ago. The vessel is now at Dover, competing, in an amicable way, with the Government packets at that station, in which she has been very successful. The saving of fuel by this invention is a matter of great importance, and we understand that in all the trials, the screw has never once been out of order. The *Archimedes*, it is said, would have made any difficult passage, such as that from Liverpool to Dublin, during the winter, in as little or less time than the best steamer upon the station, and with half the fuel, because she would have often gone quicker by sailing than others by steaming. She is stiff under canvass, and sails beautifully—the screw being no impediment. The inactivity of the company for so many months was occasioned by the repeated accidents to the engine, and not by any difficulties about the invention itself. Ib.

Wealth in Russia.

M. de Tiszkiewicz, the richest landholder in Russian Lithuania, died a short time since. The St. Petersburgh papers inform us that he left to his three sons 2,000 villages, containing more than 60,000 serfs, and in ready money 10,000,000 crowns, and that it was this gentleman who was said to have refused the hand of his daughter to Duke Alexander of Wurtemberg, who afterwards married the Princess Marie d'Orleans. His daughter has since married Prince Sapicha, and had 2,000,000 of crowns for her dowry. A letter from St. Petersburgh says—"This gentleman's property comprised 46 extensive domains, on which there are 20,000 families of peasantry, reckoning in them 60,000 males. In money he possessed 56,000,000 Polish florins, equal in French money to 21,600,000 francs. He had had six children, of whom three sons, besides his daughter, survive him. The eldest, according to the laws of Lithuania, inherits the whole of this immense wealth. He, however, has assigned one-fourth to be equally divided between his two brothers. Galignani's Messenger.

LUNAR OCCULTATIONS FOR PHILADELPHIA, SEPTEMBER, 1840.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
8	13	48	Im. 2 Capricorni,	5	145°	187°
8	14	50	Em.		281	326
9	13	41	Im. e Aquarii,	6	129	165
9	14	50	Em.		303	347
11	15	53	Im. 21 Piscium,	6	67	111
11	16	28	Em.		359	46
20	14	34	Im. η Cancri,	6	1	308
20	14	46	Em.		337	284

Meteorological Observations for April, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
⊗	1	33	56	29 85	29.90	S E.	Calm.		Cloudy—do.
	2	31	52	30.10	30.10	W.	Moderate.		Clear—do.
	3	31	62	29.90	29.90	S W.	do.		Clear—do.
	4	46	62	.50	.55	W.	Brisk.		Clear—flying clouds.
	5	40	58	.85	.87	W.	do.		Partially cloudy—clear.
	6	46	52	30.05	30 05	N W.	Moderate.		Cloudy—do.
	7	33	47	.10	.29	N.W.	do.		Clear—do.
	8	39	50	.20	.20	E.	do.		Clear—flying clouds.
☾	9	29	56	.23	.23	E.	do.		Clear—do.
	10	41	60	.25	.25	S.W.	Brisk.		Cloudy—clear.
	11	45	74	.10	.05	S E	Moderate.		Clear—flying clouds.
	12	54	66	29.85	29.75	S.W.	do.	3.40	Rain—thunder shower.
	13	44	54	.76	30 15	N.W.	Brisk.		Clear—do.
	14	40	60	30.30	.10	S E.	Moderate.		Clear—cloudy.
	15	47	62	29.95	29.95	W.	do.		Cloudy—do.
☉	16	59	71	.95	.99	S.E.	do.		Clear—hazy.
	17	48	72	.95	.95	S.W.	Brisk.		Clear—do.
	18	56	77	.80	.75	S.	do.		Clear—do.
	19	50	64	.90	30.00	N.W.	Moderate.		Cloudy—clear.
	20	42	64	30.10	.10	W.	Brisk.		Clear—do.
	21	37	60	.23	.25	E.	Moderate.		Clear—do.
	22	41	56	23	.00	S.E.	do.		Cloudy—do.
	23	60	83	29.75	29.75	S.W.	Brisk.		Flying clouds—clear.
☽	24	63	79	.75	.80	W.	Moderate.		Partially cloudy—do. do.
	25	60	79	.90	.83	E.	do.		Fog—lightly cloudy.
	26	60	84	.80	.80	E.W.	Brisk.	.25	Fog—clear—thunder shower.
	27	44	56	.85	30.10	N W.	Blustering		Clear—do.
	28	43	64	30.33	.35	E.	Moderate.		Lightly cloudy.—do. do.
	29	54	58	.05	29.90	E.	do.	2.20	Rain—do.
	30	56	71	29 65	.73	W.	do.		Clear—do.
	Mean	45.30	64.63	29.97	29.98			5.85	

Thermometer.				Barometer.
Maximum height during the month.	84.00	on 26th.		30.35 on the 28th.
Minimum " "	29.00	on 9th.		29.50 " 4th.
Mean	54.965			29.975

S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
5⅔	.	⅓	.	20⅔	.	.	.	....	.	.....	....	.	981
2	1⅔	9	3⅓	4⅓	.	.	1⅓	....	.	.....	....	.	959
4⅔	.	10⅓	.	4⅓	.	9⅓	.	....	.	.....	....	.	969
⅓	4	5	⅔	15	.	.	.	....	.	.....	....	.	934
1	1⅔	4⅔	2⅓	10⅓	.	⅔	3⅔	14.40	6	.....	....	.	938
5	⅓	6	3⅔	4⅓	1⅓	.	.	20.72	1	.....	29.65	1	956
2⅓	.	6	.	3⅓	⅓	5⅓	.	....	.	.....	....	.	931
2	.	2	.	7	.	17⅓	.	....	.	.....	....	.	937
3⅔	⅓	4⅔	1⅔	2⅓	.	12	.	....	.	.....	....	.	935
2⅔	⅓	7⅔	1⅓	2	⅓	7⅓	.	....	.	.....	....	.	933
7⅓	.	8⅓	⅓	7⅓	.	⅓	1	....	.	.....	....	.	966
1	.	13⅓	.	8	.	3⅓	⅔	....	.	.....	31.07	16	957
4	.	15⅔	⅓	3	.	4	⅔	....	.	.....	...	.	942
7	6⅓	4	⅓	2	.	6⅓	.	....	.	.....	....	.	971
10⅔	.	⅔	.	5⅔	.	13⅓	.	....	.	.....	....	.	991
⅓	.	12	.	⅓	⅓	8⅓	.	....	.	.....	....	.	950
.	.	.	.	.		.	.	....	.	.....	....	.	940
16	.	4	.	⅔	.	.	.	....	.	.....	....	.	936
.	.	.	.	1	.	.	3⅔	....	.	.....	....	.	972
2⅓	5⅓	5⅔	2	1⅓	⅓	2⅔	.	....	.	.....	....	.	954

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METEOROLOGICAL REPORT
FOR THE STATE OF PENNSYLVANIA,
Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for
JANUARY, 1840.

			Thermometer.							Register.			Barometer.							Weather.								Winds.																		Hygrometer.					
County.	Town.	Observer.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
1 Philadelphia,		
2 Montgomery,		
3 Bucks,	Newtown,	L. H. Parsons,	21.38	30.08	22.94	42.00	—2.00	24.80	.	—5.00	17.35	.	30.03	30.01	30.07	30.58	29.28	30.04	.	14	16⅔	⅓	....	....	....	..	.....	⅓	.	4	.	.	.	.	.	.	.	5⅔	.	½	.	20⅔	.	.	.	....	.	.....	....	.	991
4 Lehigh,		
5 Northampton,		
6 Monroe,	Stroudsburg,	A. M. Stokes,	12.74	25.83	15.09	45.00	—15.00	17.89	3⅓	....	....	.	29.49	29.48	29.50	30.25	28.75	29.49	2⅓	9⅔	18⅔	2⅔	....	....	....	..	.....	3⅔	.	4⅓	.	1⅓	.	.	.	.	.	2	1⅔	9	3⅓	4½	.	.	1⅓	....	.	.....	....	.	959
7 Pike,		
8 Wayne,		
9 Susquehanna,	Silver Lake,	E. W. Rose,	11.26	20.19	14.71	39.00	—15.00	11.54	.	—17.00	8.74	.	27.89	27.89	27.85	28.50	27.25	27.87	.	11⅔	19⅓	.	....	2	....	..	.800	.	.	.	.	1	.	.	.	1⅓	.	4⅔	.	10⅓	.	4½	.	9⅓	.	....	.	.....	....	.	969
10 Luzerne,		
11 Schuylkill,	Port Carbon,	Port Carbon Lyceum,
12 Berks,	Reading,	C. F. Egelmann,	19.00	25.84	20.81	45.00	0.00	21.88	.	....	....	.	29.83	29.81	29.80	30.35	29.12	29.81	.	13⅓	17⅔	.	3	3	1	..	.....	⅓	.	⅔	.	2⅓	2	⅔	.	.	.	⅓	4	5	⅔	15	.	.	.	....	.	.....	....	.	934
13 Chester,		
14 Delaware,	Haverford,	Haverford School,	19.99	28.39	22.90	50.00	4.00	23.76	⅓	4.00	18.90	.	29.50	29.55	29.52	30.13	28.80	29.52	⅔	11	19⅓	⅔	...	....	....	..	1.518	1⅔	⅔	1⅔	.	1	⅓	.	.	1⅓	.	1	1⅔	4⅔	2⅓	10⅓	.	⅔	3⅔	14.40	6	.....	....		938
15 Lancaster,	Lancaster,	Conservatory of Arts,	20.14	29.98	22.60	48.50	1.00	24.24	.	1.00	18.11	.	29.49	29.47	29.50	29.98	28.75	29.49	.	15	16	.	4	5	....	..	2.607	⅔	1⅓	1⅓	1	.	.	4⅓	⅔	⅓	⅓	5	⅓	6	3⅔	4⅓	1⅓	.	.	20.72	1	.....	29.65	1	956
16 York,		
17 Lebanon,		
18 Dauphin,		
19 Northumberland,	Northumberland,	Andrew C. Huston,	14.72	26.82	12.77	45.00	—21.00	18.10	.	—24.00	9.16	.	29.43	29.41	29.44	29.92	28.63	29.43	.	8⅓	22⅓	⅓	2	8	1	..	2.143	3⅔	.	1	.	2⅔	.	2⅓	⅓	3⅔	.	2⅓	.	6	.	3⅓	⅓	5⅓	.	....	.	.....	....	.	951
20 Columbia,		
21 Bradford,		
22 Tioga,		
23 Lycoming,		
24 Union,		
25 Mifflin,		
26 Juniata,	Mifflintown,	J. A. Rinkead,	15.37	30.64	19.72	49.00	—22.00	21.98	.	....	....	.	29.47	29.46	29.49	30.00	28.77	29.47	.	12	17⅓	1⅔	....	...	...	..	.....	⅓	.	1⅓	.	1	.	.	.	.	.	2	.	2	.	7	.	17⅓	.	....	.	.....	....	.	937
27 Perry,		
28 Cumberland,	Carlisle,	Prof. W. H. Allen,	14.42	28.23	19.42	42.00	—14.00	20.69	.	—14.00	13.65	.	29.39	29.39	29.38	29.90	28.79	29.39		12	19	.	2	5	1	..	2.063	⅓	.	3⅔	.	⅔	.	⅔	.	⅔	⅓	3⅔	⅓	4⅔	1⅔	2⅓	.	12	.	....	.	.....	....	.	935
29 Adams,	Gettysburg,	Prof. M. Jacobs,	17.88	29.88	21.34	44.00	—13.00	23.04	.	—13.00	15.24	.	29.40	29.37	29.40	29.89	28.29	29.39	.	12⅔	18⅓	.	6	2	1	..	2.463	3⅔	⅓	1⅓	.	⅓	.	.	.	2⅓	1⅓	2⅔	⅓	7⅔	1⅓	2	⅓	7⅓	.	....	.	.....	....	.	933
30 Franklin,		
31 Huntingdon,		
32 Centre,	Bellefonte,	John Harris,	12.42	25.47	17.07	45.00	—27.00	18.32	⅔	—28.00	8.13	8	29.25	29.25	29.29	29.77	28.54	29.26	⅓	8	22⅔	⅓	....	....	....	..	.....	1	.	4	.	⅓	.	1	.	.	.	7⅓	.	8⅓	⅓	7⅓	.	⅓	1	....	.	.....	....	.	965
33 Potter,		
34 M'Kean,	Smithport,	Richard Chadwick,	12.71	24.23	18.50	46.00	—24.00	18.48	⅔	—24.00	9.00	1	28.07	28.08	28.08	28.90	27.45	28.08	⅔	3⅔	26⅔	⅔	1	4	....	..	1.533	2⅓	.	.	.	2	.	⅓	.	.	.	1	.	13⅓	.	8	.	3⅓	⅔	....	.	.....	31.07	16	957
35 Clearfield,		
36 Cambria,	Ebensburgh,	Richard Lewis,	13.90	22.23	17.84	44.00	—10.00	17.99	⅓	—12.00	7.32	9	27.70	27.68	27.71	28.16	27.10	27.70	⅓	6⅔	22⅔	1⅔	3	5	1	..	.....	1	.	⅓	.	⅓	.	1	.	⅔	.	4	.	15⅔	⅓	3	.	4	⅔	....	.	.....	...	.	942
37 Bedford,		
38 Somerset,	Somerset,	George Mowry,	16.50	26.71	21.23	47.00	—22.00	21.48	.	....	....	.	27.81	27.83	27.87	28.36	27.60	27.84	.	7⅓	21⅔	2	11	....	....	..	.....	⅓	2⅓	1⅔	.	⅔	.	.	.	.	.	7	6⅔	4	⅓	2	.	6⅓	.	....	.	.....	....	.	971
39 Indiana,	Indiana,	Richard White,	20.00	26.71	22.06	50.00	—20.00	22.92	.	—15.00	12.30	9	28.55	28.52	28.53	29.00	27.90	28.53	.	7⅔	23⅓	5	6	1	....	..	3.141	.	.	.	.	⅓	.	⅓	.	.	.	10⅔	.	⅔	.	5⅓	.	13⅓	.	....	.	.....	....	.	991
40 Jefferson,		
41 Warren,	Warren,	R. Brown,	13.38	27.76	16.71	43.50	—26.00	19.28	.	...	....	.	28.79	28.74	28.74	29.15	27.50	28.76	.	6	25	.	....	....	...	..	.....	4⅓	.	.	.	⅓	.	1	.	3⅔	.	⅓	.	12	.	⅓	⅓	8⅓	.	....	.	.....	....	.	950
42 Venango,	Franklin,	Wm. Connelly,	11.16	26.48	18.42	53.00	—26.00	18.69	.	....	....	.	....	....	....	....	....	....	.	7⅔	23⅓	.	3	3	....	..	.....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	....	.	.....	....	.	940
43 Armstrong,		
44 Westmoreland,		
45 Fayette,		
46 Green,		
47 Washington,		
48 Allegheny,		
49 Beaver,		
50 Butler,	Butler,	Jacob Mechling,	10.65	25.76	17.37	46.00	—28.00	17.93	.	....	....	.	....	....	....	....	....	....	.	8	23	.	....	10	....	..	.....	.	.	⅔	.	8	.	1⅔	.	.	.	16	.	4	.	⅔	.	.	.	....	.	.....	....	.	936
51 Mercer,	West Greenville,	John Keck,	19.40	24.78	24.17	45.00	—20.00	22.78	3⅔	....	....	.	28.79	28.78	28.78	29.32	28.06	28.78	2⅔	2	12⅓	16⅔	....	....	....	..	.....	10⅔	.	.	.	.	.	.	.	15⅓	.	.	.	.	.	1	.	.	3⅔	....	.	.....	....	.	972
52 Crawford,		
53 Erie,	Erie,	Erie Academy,	19.19	26.71	19.85	44.00	—1.00	21.92	.	—2.00	16.32	.	29.31	29.33	29.31	29.84	28.46	29.31	.	1⅓	29⅔	.	3	9	1	..	2.170	1⅓	1	⅔	1⅔	.	⅓	1⅔	⅓	1	3⅓	2⅓	5⅓	5⅓	2	1⅓	⅓	2⅔	.	....	.	.....	....	.	954

JOURNAL

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OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

AUGUST, 1840.

Practical and Theoretical Mechanics and Chemistry.

Arts and Artisans at Home and Abroad: with sketches of the progress of Foreign manufactures. By Jelinger C. Symons, Esq., *one of the assistant Commissioners on the hand-loom inquiry, &c.*

[continued from page 10.]

Facts from the Factories, and Sketches of the Produce in Switzerland and Austria.

Switzerland.—The following was the number of spindles (almost all mules) in the cotton factories of Switzerland in May, 1836, when a census was taken:—

Canton de	Zurich,	292,916
"	St. Gall,	78,570
"	Glarus,	40,100
"	Schwyz,	5,760
"	Thurgovie,	26,400
"	Argovie,	123,536
"	Berne,	10,000
"	Bale,	31,400
		608,682

Since that period, from 30,000 to 40,000 spindles have been put into activity; and there are at this time mills building, in the neighbourhood of St. Gall chiefly, which, when completed, will contain from 100,000 to

150,000 more, so rapid is just now the increase in the cotton-spinning trade of Switzerland. I have visited many of the Swiss mills and likewise of the Scottish mills, and I can distinctly state, that in no respect are those of later origin in Switzerland inferior to those of Scotland. The water-power is of course invaluable, and gives an advantage of which it is not easy to over-estimate the value. The Swiss mills are generally of less magnitude than the English or Scotch mills. At Uznacht there is a splendid new mill, belonging to a company, driving 24,480 spindles, just erected, of four stories, containing 100 windows on each side. It is fitted up in first-rate style, and is remarkable for its cleanliness and airiness. It has an unceasing supply of water from a mountain torrent, which descends immediately behind it. The largest mills are those at Windisch and Turgi, with 35,000 spindles each, belonging, the former to Henry Kemtz, and the latter, to the Brothers Bebie. The average number of spindles in the Swiss mills is not above 1000 spindles, but that is including a great number of very small ones, which drive from 100 to 200 each. From 2000 to 6000 are the commonest number of spindles in a mill.

The average prices of the yarn (mule twist) are as follows:—

	s.	*d.*
No. 40, good second quality,	1	0
" 40, best second,	1	2
" 40, first quality,	1	3
" 60, good second quality,	1	5
" 60, best second,	1	6½
" 60, first quality	1	8
" 70,	1	7½
" 70,	1	9½
" 70,	2	0
" 80,	2	0
" 80,	2	2
" 80,	2	3

Upwards of 40,000 cwt. of raw cotton is consumed in the canton of Zürich alone, mostly spun into Nos. 30 to 50, though up to No. 130 are spun in small quantities. About one-seventh of the cotton tissues are printed. The total number of individuals engaged from first to last in the cotton manufactures, is but little short of 20,000. A large importation of English yarns from Nos. 80 upwards, finds its way to this and the neighbouring canton of St. Gall.

The numbers spun are mostly under 80s, but I have lately seen some excellent yarn of No. 120s spun in one of the Swiss mills, and I believe that the preparations making to spin it extensively for the muslins will succeed. Indeed with English engineers to assist them, it is difficult to see how they can possibly fail.

I am as confident as of any opinion I ever entertained, that at no distant period the English yarn, at any rate those under 150s, will find no market in Switzerland; and that of that portion now sent there to be thence smuggled into other countries, a very large portion will be supplied by Switzerland.

Mr. Wegermann, of St. Gall, told me, that they had little doubt of soon exporting cotton twist, and that they had already made the experiment at Leipsig with great success, realizing a fair profit. Mills are now erecting which will spin 160s.

The only great disadvantage they possess in Switzerland, is higher priced iron; as to fuel, they enjoy an exemption from it altogether, from the abundance of water power. Whatever disadvantages remain to be deducted, on the score of carriage of the raw material, &c., are balanced by the rate of wages being at least one-third below the average in Lancashire. Machine-making is advancing rapidly in perfection, and the aptitude of the work-people is advancing in improvement; but when these elements in the race are matured, I do not believe that, after the carriage is added, our yarn will find any sale in Switzerland.

There are several cotton-spinning mills in Argovia.

The prices of this production have fallen considerably here as elsewhere. No. 40s chain (mule twist) was sold in 1813 in Arau for 7 fr. 20 cent. per English lb. It is now 1 fr. 60 cent. per lb. The reduction has been thus in far greater proportion than even that of the cost of the raw material; for, in 1813, cotton wool of medium quality, was 300 fr. per quintal, and now costs 108 fr. per quintal. The reduction in the price of twist having been in double proportion, proves the advance made in the aptitude of the workmen, and the perfection of machinery: though cotton-spinning was at one period (1828) threatened by the opposition of the working classes, who, (where one-fourth of the whole population vote) have the government of the canton entirely in their own hands. In 1830, the labouring classes opposed themselves with renewed vigour to the cotton mills, and two years afterwards some outrages were committed. The power of education triumphed, however, over the narrow prejudices on first-sight impressions, which alone countenance doubts as to the benefit to the people of increased machinery. The people themselves recognized the truth of the great principles which demonstrate the inseparable identity of their own interests with the abundance of those productions which constitute the wealth of a nation, and necessarily regulate the labourer's share. The labouring classes (themselves the legislature) have enacted laws confirming and promoting the march of machinery.

Woven Goods, or Tissues.—I shall speak of these *seriatim*, and in the same detail as I have reported on them to Parliament, as they are objects of peculiar interest to English manufacturers.

Walkringen is the chief seat of the manufacture of damasks; and, from its growth within a comparatively recent period, there is every reason to apprehend that these articles will eventually hold a first-rate rank among the productions of the Swiss looms. The Messrs. Miescher of Walkringen, and Col. Geisbühler of Berne, were good enough to give me much information as to this branch of industry. From them and others I found that the Bernese table-cloths and napkins, are, by their cheapness, enabled to compete even with those of Belgium. I saw some damask napkins 33 English inches and 2,800 chains in the breadth, a good deal over-wefted, with a pattern about 3 inches square, of which the wholesale price (bleaching included) was 3 fr. per French ounce of 44 inches. They were certainly not so well made as at Courtray or Dunfermline, but were perfectly saleable articles.

A large quantity of trowser stuffs are also manufactured in the same district; some are of duck, others with a mixture of wool, and many striped, chiefly for the South American markets, whither considerable exportations are made. Berne and Langenthal in the Canton of Arau, are the chief markets for the linen webs of the Bernese district.

The wages of the linen weavers are lower, when the price of provisions

is considered, by about 15 per cent. than at Dunfermline, where unions have existed.

Ginghams and ribbons are the chief tissues woven in Argovia.

I was shewn, among a multitude of other articles, a 12^{00} gingham, 30 inches in width, with Turkey red and white check. Chains about No. 20s and weft 40s, overwefted in the proportion of 20 to 17. The weaving of this was 11 fr. for 82 French ells of 44 inches each. Winding and all *et cæteras* paid for by the weaver. The piece of 82 ells, usually woven in a fortnight; gross wages, therefore, on this work would be only 5fr.50 per week (or 4*s.* 7*d.*,) from which winding, say 7*d.*, has to be deducted, together with all the incidental expenses to the weaver of upholding the loom, for which deduct 1*s.* more, leaving 3*s.* per week net wages. The sale-price of these ginghams, wholesale (fast colours,) average about 9*d.* per French ells, or $7\frac{4}{11}$ per English yard; discount 10 per cent.

A sort of striped ginghams are woven here a good deal, for Italian cloaks (stripe in the weft) 12^{00} cram, 45 inches wide. These goods are for printing on. Wages paid for weaving are 27 fr. for 90 ells, of which 6 ells are considered a good day's work; making about 13 fr. 50 cents., or 10*s.* 10*d.* per fortnight, gross wages. Price of these goods wholesale is 2 fr. 50 cent. per ell; discount 10 per cent.

A large branch of the industry of Argovia is devoted to the production of straw and silk articles, chiefly for the Italian and American markets. The wages paid for these do not materially differ from the above. The profits gained in the manufacture of these goods are exceedingly large, owing to improvements of recent date, and the comparative monopoly, as yet, of the trade in the hands of a few manufacturers.

Silk Tissues in Zurich.—Since the fifteenth century the silk manufactures of Zurich have been known to Europe. The manufacture of ginghams and other cotton goods, as well as of worsted and woolens, is also carried on to a considerable extent.

The silks are chiefly plain, and even those which are figured are of a lighter texture than the produce of the Lyonese looms, with which the Zurich manufactures are in direct competition.

At Hausen, which I visited for the purpose of investigating the silk-manufactures in the strong-hold of their fabrication, I collected a great deal of information on the prices of weaving, and the fabrics themselves. I select the following:—

1. Marcellines plain black silk, 18^{00} (*i. e.* having 3600 chains in the width of $37\frac{1}{4}$ inches;) width 31 inches. Wages, 30 fr. for 60 ells. Time, four weeks making, 7 fr. 50 cent. gross wages per week. Wholesale price of these silks, 5 fr. 85 cent. per ell.

2. Gros d'Orleans, 16^{00}, thick warp and weft, width 31 inches. Turin organsine chain, 28 a 30. Milan weft, 28s to 36s. Wages 40 fr. per 60 ells; average period of work six weeks, or 6 fr. 66 cent. gross wages per week; price 8 fr. 60 cent. per ell.

3. Florentine plain white silk, 18^{00}, (or 3600 chains in $37\frac{1}{4}$ inches;) 22 inches wide, single wefted (*tramé à un bout.*) Weight of weft for whole piece, 2 livres 2 ounces; do. do. or chains of organsine, 30 ounces. Wages for whole piece, 15 fr.; time necessary on average to complete it, nearly 3 weeks; giving average gross wages 5 fr. per week; selling wholesale price, 2 fr. 80 cent.

4. Serge, (silk) thin and fine, 22 inches wide, vary 8 fl. or 20 fr. for 52

ells; woven in $3\frac{1}{4}$ weeks, or 23 days' labour; making $17\frac{1}{2}$ sous per day, or 5 fr. average per week. Price 3 fr. 50 cent. per ell.

5. Green Florentine, 18^{00}, single wefted, 17 inches wide. Wages 9 fr. for 500 ells, requiring 2 weeks' labour, and giving average of 4 fr. 50 cent. gross wages per week; price 2 fr. per ell.

The beams are all warped by the manufacturer. The number of individuals employed in the silk manufacture cannot be estimated at less than 14,000. Improvements are constantly making in the texture, body, and designs of the fancy goods, and it is not improbable that a successful competition will be shortly established with the Lyonese looms in more articles besides the light low-priced silks.

St. Gall is the chief canton for muslins and the finer ginghams. Embroidery is also extensively carried on. I took great pains to ascertain the exact degree in which these several fabrics competed with our own. During my official inquiries in Scotland, I was frequently told of the formidable competition with the Glasgow muslins and ginghams, anticipated from the looms of this canton and the adjoining district; and a large house in the town of St. Gall was named to me, as having offered goods in the Glasgow market, at as low, or lower, prices than they could be produced at there. I obtained an introduction to the house in question. It is one of the largest in Switzerland both for woven goods and cotton twist. I furnished myself with numerous patterns of these muslins and ginghams, from a different establishment, and accurately ascertained the wholesale prices; verifying the statements made to me by the retail prices asked in the shops for the same goods. My opinion is briefly this: There are two sorts of competition between the manufacturers of two countries; first, their competition in either of their own countries; secondly, their competition in *third* countries. *In plain muslins*, though the prices are not greatly different, I am of opinion that Scotland and Lancashire will maintain their ground over Switzerland, in any market in the world; the evenness and finish of the Scottish goods, both books, jaconets, and mulls, are decidedly superior, and will procure for them the preference, I will undertake to say, in any third market, whither the cost of carriage shall not be greater than from St. Gall. But in Switzerland itself, no competition of our goods of any of the descriptions above named can be sustained with the domestic manufactures. In all these articles (except plain muslins) these cantons are unquestionably enabled to meet us, moreover, *in many third markets.* In the article of lappets, which are woven in Scotland for starvation wages, the Swiss complain that they can do nothing against us in Brezils; but in embroideries, which are most beautiful for curtains and drapery, and likewise in the large-flowered coarse muslins for the second class curtains, &c., they beat us both in price and design. In ginghams chiefly, competition is to be dreaded by our manufacturers, and also in sprigged or coloured muslins. In both of these articles, the superiority of Swiss dyes gives a preference to their goods over ours, whenever, as is the case with ginghams and coloured muslins, they can produce them as cheaply as ourselves. In order to give an idea of the evenness of the race in prices, I subjoin a table of the prices of, as nearly as possible, similar articles at St. Gall and Glasgow. I have taken, in each case, the average wholesale prices struck from the returns of different manufacturers in both places.

Articles.	Number of Chains in $18\frac{1}{2}$ in.	Width in inches	Number of Yarn	How Wefted.	Price per Yard.	
					St. Gall.	Glasgow.
			Ch. W.		s. d.	*s.* *d.*
Gingham	16^{00}	30	70s. 80s.	3 shots over	0 7	0 $7\frac{1}{2}$
Do.	18^{00}	30	80 90	equal	0 $7\frac{3}{4}$	0 $8\frac{1}{2}$
Imitation cambric	20^{00}	35	100 115	1 shot over	1 0	0 11
Mull Muslin	12^{00}	35	100 115	3 shots over	0 11	0 $8\frac{1}{2}$
Do.*	15^{00}	35	160 175	do.	1 0	0 $11\frac{1}{2}$
Figured muslin for window curtains	18^{00} 90 flower lash	46	130 145	do.	1 8	1 10
Coloured lappets	15^{00}	36	100 110	1 shot over	0 $7\frac{1}{2}$	3 9 for 10 yds.
Common muslin checks	14^{00}	35	100 110	2 shots under	0 $5\frac{1}{2}$	0 $6\frac{1}{2}$
Coloured striped muslins, turkey-eyed	14^{00}	36	95 100	do.	0 7	0 $8\frac{1}{2}$
Strong cotton stripes†	16^{00}	20	40 45	do.	with red 4d. without $3\frac{1}{4}$	....
Pullicates, turkey-red	12^{00}	30 by 28	50 55	1 shot over	4*s.* 2*d.* per doz.	4*s.* 3*d.* per doz.

* These articles are prepared and stiffened like book-muslins; the yarn from England.

† These (called Printannieres) were formerly purchased in the Scottish and English markets, but are now made in large quantities in St. Gall for the Levant, America, and Italy.

A Scotchman has been recently engaged by one of the first houses in St. Gall, to superintend the finishing of book-muslins, and the clear finish will be introduced forthwith.

They appear to manufacture articles with great taste for the Italian mar-

kets. I saw some common pullicates, very dark colours, mostly 14°°, 34 inches square, to which an appearance resembling silk had been given by the hot cylinder; they were sold at 3 florins 20 kreutzers the dozen, and large sales were, I know, effected in them.

The system of manufacturing in these districts is somewhat peculiar. The merchant is not, as in Scotland, also the manufacturer; there is a middle man between him and the weaver, who sometimes receives the yarn from the merchant, and returns him the goods woven. This personage is called the *fabricant;* he makes his own terms with the weavers, to which the merchant is not privy, and generally lives among them. As this man has his own profit to make, the wages paid for weaving are extremely low, and are as nearly as possible the same in money as those of Scotland. The average wages of adults, who work twelve and thirteen hours per day, do not exceed from *5s.* to *6s.* weekly, though on the finer work *7s.* or *8s.* may be made.

Manufacturing industry is already well developed in the canton of Glaris, and its extension is commencing in the Grisons.

In Glaris, not only are three cotton-spinning mills in the process of erection, but the weaving of the various sorts of cotton articles in St. Gall, and even for St. Gall merchants, is of considerable extent.

The Grisons is a canton hitherto remarkable more from the produce of its pastures than its looms. Nevertheless, manufacturing industry has taken root there, and, as far as cotton-spinning goes, I think it likely that, in twenty years' time, no canton will surpass it, if its natural advantages, both in respect to abundance of iron, and water, and wood, be made available.

At Bale, the ribbon manufactures are flourishing, and a brisk competition is kept up with St. Etienne.

There are not less than 15,000 persons in this and the neighbouring cantons who work for Bale manufacturers, and to whom, generally, the looms belong of those weavers who work in the town of Bale, living themselves in the suburbs. The necessity of preserving the privacy of patterns, renders it necessary to work in factories.

The other Manufactures of Bale, such as hosiery, printing cottons, &c., have entirely declined.

In Austria, the fabrics woven are nearly all sorts of cotton goods, but chiefly of the coarser descriptions.

Wages vary from *7d.* to *1s. 6d.* per day. A girl will easily earn 36 kreutzers (*1s.*) per day; and food being remarkably cheap, a weaver can live on 20 kreutzers (*7d.*) per day with great comfort, and a girl on 16 or 18 kreutzers.

The cottages and homes of the weavers indicate no poverty, though they are by no means either so clean or so comfortable as those of Switzerland; nevertheless, few are without a garden, and most of the weavers quit the loom not unfrequently for outdoor or other employment.

Mr. Kennedy, in a letter which I have recently received from him, states:—

"There are 4000 looms in this province, a number which has been ascertained officially; but what with the interruptions occasioned by cultivating the land, going to markets, &c. &c., I conceive they do not deliver more than 3000 pieces a-week; and as they have abundance of occupation, they must be exceedingly well treated, or they leave their work."

Cotton-spinning is greatly encouraged by the Austrian Government, who

have afforded this manufacture a protecting duty on our cotton twist of 15 florins on 123 lbs. English weight, about 3d. a lb. This duty added to the carriage, would prevent any English twist from entering Austria, were it not that the Austrian manufacturers choose to keep up their prices, and to realize a profit of about 11 or 12 per cent.; with less than which they would not be content. Thus the protecting duty protects them in fleecing the consumers. I had this from Mr. Kennedy himself. Accordingly, the weaving manufacturers make loud outcry and lamentation; but the spinners are at present too strong for them, and the protecting duty is maintained.

The Austrian Government most rigorously enforces the protecting duty; they make all the Austrian spinners keep a book for the entry of all the yarns spun, and the weavers of all the yarn they buy. This they compare with the imports, and are often enabled to trace the purchase of smuggled yarn to the culprit.

The internal manufactures continually approximate nearer to a total supply of the internal demand, and in the coarser calicoes some exports are taking place.

In woven goods, the Vorarlberg hand-loom weavers are subjected to the competition of those of Bohemia, where wages are much lower, and where the condition of the weaver must be fully as bad as those of Scotland and Lancashire.

In the production of yarn, the same disadvantages attend this industry which I alluded to in Switzerland, namely dearness of iron and distance from cotton marts, but, nevertheless, there is evident scope for larger produce; and the increase which has taken place in this manufacture, evidences its capacity of progress. In 1828, there were 400,000 spindles in Austria; and there are now upwards of 600,000; new mills being also in the course of erection. I extract, from the returns to the Austrian Government, one or two specimens of the productive power of their spinning machinery.

Name of Mills.	No. of Mules.	No. of Spindles.	No. of Yarn spun.	No. of 5 lb. bundles in a year.
			s. s.	
Schloppenhof (Bohemia,)	....	11,520	20 to 130	24,000
Gabel, Riehler's,	4	576	30 to 60	3,456
Schonan (Austria,)	....	25,000	30 to 70	100,000
Bludenz,*	36	5,508	34 average	24,000

The cost of erecting machinery (except to Mr. Escher, who makes it himself) is the greatest drawback. A cotton-mill of 16,000 spindles, I was informed, would cost L.37,000 to erect. From subsequent information, I should be inclined to think L.32,000 nearer the mark; this would be at the rate of L.2 per spindle; whereas, at the ordinary estimate in England of 17*s.* 6*d.* per spindle, such a mill would cost us only L.14.000; considerably less than the half. Cotton wool is brought from Trieste the whole way on the axle. However, the long hours, the low wages compared with ours, the water-power costing nothing, fully compensate for the cost of

* This last mill has been burnt down, and another of 12,000 spindles has been just erected.

erection; and this important branch of industry may be considered to be in a very thriving state.

The Messrs. Kennedy and Escher are erecting fresh mills in Piedmont and Sardinia, and a paper-making establishment at Roveredo; the extent of their enterprise is considerable, and their mills (they have also a power-loom factory nine miles from Feldkirch,) on the Austrian side of the Rhine, combine the markets of Austria and Switzerland; an advantage which could not be combined on the other side of the Rhine.

TO BE CONTINUED.

Bibliographical Notices.

Report to the Senate of the United States on Steam Navigation.

On March 2d, 1840, Mr. Ruggles, on behalf of the Committee on Commerce, submitted a REPORT, for a copy of which we are indebted to the kindness of Senator Preston.

This report, with the appendix, embraces a great variety of very interesting statistical information, and also, the opinions of some of the most skilful and scientific gentlemen of this country and of Europe, on the causes of, and means of avoiding, the disasters incident to navigation by steam.

In reference to the supposed inutility of attempting to regulate steam navigation by law, founded on the argument that, the proprietors of steam-vessels cannot be supposed to neglect any thing which would conduce to the safety of the public, since their own interest would also suffer from such neglect, the Committee very justly remark—

We have had too many proofs of the futility of relying alone on the self-interest of proprietors, or the sense of personal hazard of engineers, for security against steam disasters. Legislative regulations and penalties must, therefore, interpose their protection.

It is acknowledged that steam-travel in this county has been attended with somewhat more hazard than in England: the ascertained and reported number of accidents in England being 92, while those of the United States amount to 272. The difference much exceeds that of the number of steamers employed.

Much of this difference of hazard arises from the peculiar casualties to which steamers are exposed on the Western rivers, from snags and sawyers, and from collision in fogs, or in turning short bends in the rivers. Something, too, may be placed to the account of that racing and reckless propensity which is there subject to less rebuke, even from passengers than it meets with on the Eastern waters. Another reason for it, prolific of disaster, is to be found in the arrangement of the high-pressure boilers in the Western boats, by which the flues are more exposed to become bare of water and overheated while careening at the numerous stopping-places. Out of the 272 ascertained accidents above mentioned, 207 have occurred on the Western rivers, and 65 only on the Eastern waters and the great lakes.

The Committee are of opinion that the law of Congress, passed in 1838, has been of service, but at the same time admit, that it falls far short of shielding the public from those disasters which prompted its adoption.

Within the last year 200 lives have been lost, exceeding the average of former years.

"There were 41 accidents in 1839 on the Western waters alone. The following statistical account of them is derived from a Western publication:

Snagged	21
Struck upon rocks, &c. . . .	7
Destroyed by fire	6
Explosions	4
Collisions	3
	41

Of these, 23 were totally lost. Loss of property estimated at no less than a million of dollars.

Lives lost by explosions . . .	39
By other causes	7
	46

Snagged on the lower Mississippi . .	11
on the Missouri . . .	4
on the Ohio	4
on the Yazoo	1
on the Red river . . .	1
	21

It is spoken of as remarkable that the majority of the boats were snagged on their downward trips.

Add to these the loss of the Great Western by fire, in Detroit river, new boat, built at a cost of $100,000; the accident on board the Narraganset, on Long Island Sound, in August last, by which several persons were severely scalded (App. C;) the loss of the Lexington, by fire, on the Sound, by which about 150 lives were lost (App. B;) the collapse of a flue of the Erie, on the Hudson river; which, with a few other accidents of less moment, including many fires that were extinguished, but not particularly ascertained, make up the sum of last year's steamboat misfortunes, and furnish ample reason for some more effective legislation."

The steam tonnage of the United States, as registered and enrolled in 1839, is about 200,000 tons, and estimating the average of boats at 200 tons burden, the whole number of steamboats registered and enrolled would be 1000.

"How many there are of a smaller class, not included in the above, employed as ferry-boats, and in other local service in harbours, or as tow-boats, we have no data from which to estimate.

The following classified enumeration of the causes of accidents to steam-vessels will serve to indicate the character of the necesary measures of precaution to be adopted, and direct the application of appropriate remedies:

Explosions, caused by—

1. Bad construction of boilers in respect to form, and being insufficiently stayed.

2. Unsuitable materials used in their construction, and bad workmanship.
3. Using old boilers after being weakened by being corroded, burnt, or strained.
4. Want of sufficient safety-valves, in number and area.
5. Overloading safety-valves on an erroneous estimate of the strength of the boiler.
6. Ignorance, carelessness, recklessness, and *drunkenness* of enginemen and firemen.
7. Suffering the water to get too low in the boilers, from inattention, or want of apparatus to denote the level of the water and the temperature of the steam.
8. Want of steam gauges, or errors in their indication.
9. Inattention to frequent cleansing of boilers of saline and muddy deposites.

Fires, caused by—

1. Placing boilers too near the decks, partitions, and sides of the vessel, without defences of sheet iron, or lining of boiler-room; and having brick walls or other slow and constant conductors of heat resting on or against the woodwork.
2. Want of protection to the decks from overheated flues and chimneys; and defects in the flues, or at the junction of flues and smoke pipes, occasioned by burning or rusting.
3. Fire being blown out of the furnaces into the fire-room, among the fuel and other combustibles.
4. Stowing fuel in the fire-room, and too near the boiler.
5. Dangerous stowage of combustible merchandise, and sparks from the chimney.
6. Incautious using of lights in the private apartments.
7. Deficiency of means of extinguishing fires; and panic and confusion from the consciousness of such deficiency, without boats enough to insure escape.
8. Want of faithful fire-watch.

Wrecks, snagging and *foundering*, caused by—

1. Failing of defective boilers and engines.
2. Frail and defective hulls.
3. Want of water-tight bulkheads.
4. Deficiency of sails, and want of cables and anchors.

Collisions, caused by—

1. Want of proper signal-lights.
2. Want of a gong or "steam whistle," in fogs or thick weather.
3. Neglecting to keep a lookout.
4. Want of a defined "rule of the road."

The only practicable mode of reaching these causes of disaster is by means of a compulsory, rigid, scrutinizing inspection of the hull, boiler, engine, and all the equipment of steam-vessels, made by competent and sworn officers; not nominal and formal merely, as is too often the case under the present law, but an actual and faithful inspection."

The strictures of the Committee on the objects which most imperatively claim the attention of inspectors appointed by law, include the following:

Structure of the hull—steam-boilers,—safety-valves,—steam and water gauges, and thermometers,—fire, and means of prevention, and of escape,—

safety boats,—engineers; and the remarks of the Reporters under each of these heads, ought to claim the attention of all the Inspectors.

In reference to the duty of Congress in interposing the strength of its arm in order to arrest the apparently increasing evils, arising, as we must and do believe, in *almost* every instance, from a culpable neglect of the precautions that might be taken, the Committee furnish the following:

"*Summary of the provisions recommended to be made by law.*

1. Steam-vessels not allowed the privilege of enrolment or registry without a certificate of inspection, and payment to the collector, if the vessel be under one hundred tons burden, of $10; if between one and two hundred, $15; if between two and four hundred, $20; if over four hundred, $30.

2. A system of compulsory, thorough, and faithful inspection of the hull, boiler, machinery, and all equipments of the vessel and engine to be made by inspectors appointed by the district judges, and to hold their appointment four years, unless sooner removed.

3. Inspectors empowered to examine witnesses under oath on the construction of the hull and engine, and touching any matter of which it is their duty to inquire; to discriminate between vessels adapted to lake and sea, and those adapted only to river navigation; to inspect the hull annually; to test the boilers by hydrostatic pressure semi-annually, and oftener if necessary; may examine, on request of passengers, and to certify positively the results of their inspection; to determine and certify the maximum pressure to which the steam may be raised, not to exceed one-third of the test pressure; and also the minimum height of water, below which it may not be exhausted; to notify when a vessel becomes unsafe to transport passengers; to examine and license engineers, annually, and to revoke licenses for intemperance, neglect of duty, or misconduct; to report, annually, to the Secretary of the Treasury, the number of steam-vessels inspected, and the particulars of their equipments and condition, and particulars of accidents; to receive from the collector of the district $20 for the annual inspection of each vessel and equipments, and $15 for all other inspection of each during the year, and to receive from each engineer examined $5:

4. Steam boilers to be tested at three times the pressure allowed as a maximum; the boilers to be provided with a mercurial steam-gauge, thermometer, and glass water-gauge, or a water-float, protected by a curb from agitation and foaming, with index showing the height of the water; gauge-cocks to communicate with a tube within the boiler; boilers to have two safety-valves of approved area—one to be inaccessible to the engineer, except to raise it, to be loaded by the inspectors at the maximum pressure; the other at halfway between the maximum and the common working pressure.

5. The indications of the steam and water-gauges to be exhibited in view of the passengers, in a conspicuous part of the vessel, showing, on a scale, the pressure of steam and height of water the engine is working under.

6. Hand force pumps for injecting water into the boiler on failure of engine pump, or obstruction in the injection-pipe.

7. The boiler rooms to be made fireproof inside by a lining of sheet-iron, forced half an inch or more from the woodwork; the decks around the smoke-pipes to be similarly protected.

8. Steamers to have two or more effective fire engines, double force pumps, or rotary pumps, one on the forecastle and the other aft, drawing water by suction-pipes through the bottom of the vessel, and hose to each to convey water to any part of the vessel; also, forty buckets, with bailing-ropes attached; and axes; and two or more tanks on the promenade-deck, holding not less than three hundred gallons, to be kept filled with water.

9. Lake, sound, and sea-going steamers, to have an equipment of sails; and safety boats sufficient to carry all the passengers and crew—one-half, at least, in capacity, to be life-boats. River steamers under one hundred and seventy-five tons, to have boats to carry at least forty persons; over one hundred and seventy-five tons, boats to carry seventy persons.

10. Metallic tiller chains or rods to be used instead of ropes, except so much as passes round the tiller-wheel; the chain to be capable of being disengaged at the stern; and a spare tiller to connect with the head of the rudder-post.

11. At night a white light to be elevated forward, and a red light aft; the former twelve feet above the upper deck, the latter three feet lower; to have a steam safety pipe, to be sounded every half-minute in fogs or thick weather.

12. As "a rule of the road," steamers meeting "stem on," to starboard their helms, and pass to the left, except that in rapid rivers the ascending steamer shall have the preference of the inshore slack water and eddies; the descending steamer the preference of the current. Steaming vessels meeting sailing vessels, to pass to the windward, yielding the course and giving good berth to the sailing-vessels, whatever may be the direction of the wind.

13. Engineers to be of two classes—chief engineers and sub-engineers; to have license from the inspectors, after examination into their competency and skill, sobriety, and good moral character; none others to be employed. Every boat to have one chief engineer, and a competent number of sub-engineers. Certificate of inspection, and of examination of engineers, to be posted up on board.

14. Sea, sound, and lake going steamers, not to carry gunpowder. Steamers on rivers emptying into the Gulf of Mexico and their tributaries, not to carry gunpowder except in iron chests, and notice thereof to be posted up on board.

15. The putting on board of any sailing-vessel or steam-vessel, gunpowder, secreted in other merchandise, disguised, or falsely marked, or without information to the master, to be punished as a misdemeanor, and powder forfeited.

16. Inspectors punishable for giving certificate without examination, or for certifying knowingly what is not true.

17. All duties enjoined to be enforced by penalties.

18. Any person employed on board of steamboats, by whose negligence or misconduct the life of any passenger shall be destroyed, to be considered guilty of manslaughter, and punished by imprisonment.

19. For carrying excess of steam, or working the water below the point prescribed, penalty and forfeiture of wages.

20. Owners and masters to be considered as common carriers, and liable as such; and all agreements and notices to the contrary made void.

21. The fact of injury to person or property on board by steam, fire, or collision, to be *prima facie* evidence of negligence; and owners liable

for the wilful misconduct as well as the negligence of those in their employment.

A compliance with regulations of the foregoing description cannot be attended with great expense to the owners of steam-vessels; certainly in no degree commensurate with the advantages to be derived in the security they will afford to human life. The proprietors themselves, it is believed, will find their own pecuniary interest subserved thereby, in securing a greater degree of public confidence in steamvessels, and a consequent increase of patronage, as well as in lessening the hazard attending this species of property, and affording them the benefit of a diminished rate of insurance."

The committee, therefore, report a bill embracing the foregoing provisions.

In the first page of the appendix we have the following valuable statistics of the amazing extent of this new and Herculean power; and while it reminds us of the extraordinary animation and zeal with which we have heard the great pioneer into this new world of wonders (Robert Fulton) dilate upon the prospects which his success and his confidence were unfolding to the visions of his wakeful and energetic mind, we cannot but believe that his revelations fell short of the reality. His opinion was, that steam would effect a most beneficent revolution in the navigation of the father of rivers and its accessible tributaries. That the epoch of this change should have so soon and so fully arrived, is an evidence at once of the astonishing enterprize of the inhabitants of the great valley of the Mississippi, and of the energy of character which the power of steam is prone to elicit.

We find by the table that great as is the steam tonnage of New York and a few other states, the single port of New Orleans enrolls nearly one-third of the whole of the United States.

"*Statement showing the amount of steam tonnage of the United States registered and enrolled, as returned by the several collectors on the 30th September*, 1839.

DISTRICTS.		Registered Tonnage.	Enrolled Tonnage.
		Tons and 95ths.	Tons and 95ths.
Waldoboro',	Maine .	"	67.53
Bath,	" .	"	575.14
Boston,	Massachusetts	"	2,243.10
New Bedford,	"	"	57.01
Nantucket,	"	"	171.20
Providence,	Rhode Island	"	487.00
Newport,	" .	"	211.11
Middletown,	Connecticut	"	796,29
New London,	"	"	346.45
New Haven,	"	"	784.10
Fairfield,	"	"	291.70
Vermont,	Vermont	"	1,364.42
Sackett's Harbor,	New York	"	896.80
Oswego,	"	"	629.20
Genesee,	"	"	139.00
Oswegatchie,	"	"	508.62
Buffalo Creek,	"	"	4,916.00

Seam tonnage Continued.

DISTRICTS.		Registered Tonnage.	Enrolled Tonnage.
		Tons and 95ths.	Tons and 95ths.
Sag Harbor,	New York	"	29.87
New York,	"	"	30,348.57
Perth Amboy,	New Jersey	"	498.47
Newark,	"	"	291.55
Camden,	"	"	1,136.57
Philadelphia,	Pennsylvania,	"	8,424.55
Pittsburg,	"	"	11,864.71
Wilmington,	Delaware	"	373.60
Baltimore,	Maryland	360.31	7,754.83
Annapolis,	"	"	336.42
Georgetown,	Columbia	"	1,123.35
Alexandria,	"	"	984.16
Norfolk,	Virginia	"	1,209.85
Richmond,	"	"	147.70
Wheeling,	"	"	2,268.74
Charleston,	South Carolina	74.00	2,984.05
Savannah,	Georgia	2,217.87	4,294.91
Brunswick,	"	"	408.03
Miami,	Ohio	"	1,801.30
Cuyahoga,	"	"	3,917.46
Sandusky,	"	"	2,272.67
Cincinnati,	"	"	9,159.47
Detroit,	Michigan	"	3,160.17
Mobile,	Alabama,	236,54	3,714.06
Louisville,	Kentucky,	"	8,125.87
St. Louis,	Missouri	"	9,735.00
Nashville,	Tennessee	"	4,240.94
New Orleans,	Louisiana	2,314.93	61,213.67
Appalachicola,	Florida	"	1,559.67
Total .		5,203.65	194,365.94

Recapitulation of the steam tonnage of the United States.

	Tons—95ths
Employed on the Eastern waters : . .	54,473.59
Employed on the lakes	341.27
Employed on the Western waters (rivers) . .	108,923.58
Employed south of the Potomac river . . .	17,831.15
	199,569.59

The appendix contains the testimony taken before the coroner and jury relative to the burning of the Lexington—with a description and strong recommendation of Francis' Life Boats. We also find in it abstracts of the laws and regulations of foreign states respecting steamboats. Those of France we think it right to copy:

France.

Cast-iron boilers prohibited.

High-pressure boilers to be proved by the hydraulic press, to at least three times the degree of pressure at which it is intended to use the steam. The owners to find the press and labour.

Rectangular boilers exempted from proof when used to raise low-pressure steam, *i. e.*, steam not exceeding 7 lbs. pressure per square inch above the atmosphere.

All cylinders, and cylinder jackets of steam-engines, whether using high or low steam, to be proved to three times the working pressure.

The above rules apply to all engines and boilers, whether employed on land or water. The following are special laws as to steam-vessels:

1. No steamer to ply until certified to be seaworthy in hull, boilers, and machinery; to undergo subsequent inspection every three months.

2. No certificate granted, but on the express condition of the engineman being a skilful mechanic, and possessed of sufficient knowledge to maintain the machinery in good order, and repair it if necessary. No fireman allowed to act as engineman, but to be subject to the order of the latter. The engineer to observe precautionary rules, to be hung up for his guidance in the engine room.

3. Every boiler to be provided with a water float and index, two glass water-tubes, three gauge-cocks, and an open-ended mercurial steam-gauge. It is also recommended to apply a safety-pipe, with a whistle at the end of it, to give notice when the water is too low.

4. Two safety-valves required to each boiler, of not less than a certain area. High-pressure valves to be loaded by means of a lever; low-pressure with a solid weight upon them. All additional weight, after the survey, prohibited. The prescribed pressure stamped on the valve-boxes.

5. Two disks of fusible metal to be fixed on all boilers, in the steam-space or chest, having different degrees of fusibility, and different dimensions; the smallest and most fusible to have an area equal to that of one of the safety-valves; the largest and least fusible to have an area equal to four times that of the valve. These disks are supplied, after proof of the boilers, and according to the pressure at which it is intended to work: all change of them prohibited, and duplicates to be carried in every vessel.

6. Instructions given for the management of the fires, and for the conduct of the engineer and captain reciprocally, when the vessel has to stop, &c.

7. The captain to be personally responsible for all accidents arising from excessive velocity; and owners, for all accidents which may arise from the non-observance of the laws and regulations.

8. A ruled log-book, or diary, to lie open in the cabin, in which passengers are requested to write their observations concerning the events of their journey and the performance of the vessel: these books to be examined by the police authorities and commissioners on their periodical visits. In the cabin is to be placed a table, indicating—

1. The mean duration of a trip.
2. The time allowed for stoppages.
3. The maximum number of passengers permitted by the law.
4. The right given to passengers to inscribe their remarks in the log-book.

9. The minutiæ of the *procès verbaux* by the commissioners, &c., are particularized.

10. Tables of the elastic force and temperature of steam, from 1 to 50 atmospheres of pressure, are given, together with the areas of safety-valves and fusible disks proper for each pressure, as determined by a commission of the Royal Institute."

The appendix is enriched with a valuable mass of "extracts and communications addressed to the British Commissioners of Steamvessels," constituting more than half of the document issued by the Senate. Our limits will not admit of extracts from them, but of their value to all who are concerned in the business of steam craft we have a high opinion. G.

Rail-roads in the United States. By Chevalier De Gerstner.

Rail-roads in the State of Pennsylvania.

The first rail-road in America was constructed in Pennsylvania, and the same State has at present the greatest extent of rail-roads in operation. With the exception of only two lines, all have been constructed by private companies. Some of those established at an early period were designed exclusively for the transportation of coal from the mines to the place of their transhipment. For the construction of these roads little regard was paid to the grades and curvatures; and inclined planes were frequently resorted to. The other rail-road lines, generally of a much greater length, are used for the transportation of passengers and freight. The manner of construction of the different rail-roads in this State is very various, and it is of great interest to follow all the improvements made in this respect since the construction of the Mauch Chunk Rail-road, finished in 1827, up to the present time, when all the experience acquired during 13 years is brought into application; on the Reading Rail-road, for instance. With the exception of some of the oldest coal rail-roads, the tracks have an uniform width of 4 feet 8½ inches, the same as was adopted in England. The superstructure is generally of wood—flat bars upon continuous bearings, or heavy T rails upon wooden cross ties. As motive power, stationary and locomotive steam engines, horses and mules, and gravity, are used.

The following table contains a list of all the rail-roads in the State of Pennsylvania either completed or in progress of construction,* and has been prepared after a personal examination of the different works:

* A. D. 1839.

Rail-roads completed and in progress in the State of Pennsylvania.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Philadelphia & Columbia	Philadelphia to Columbia.	1834	82			82	41 lbs.	36 locomot's	4.000.000		4.000.000	48.780
2	Alleghany Portage,	Johnstown to Holidaysburg.	1834	$36\frac{2}{3}$			$36\frac{2}{3}$	$39\frac{1}{2}$ lbs.	17 "	1.850.000		1.850.000	50.450
3	West Chester,	Columb. & Phil. R. R. to W. Chester.	1834	9			9	$2\frac{1}{4}\times\frac{5}{8}$	horses	90.000		90.000	10.000
4	Valley,	Columbia & Philad'a. R. R. to Norristown.			10	$10\frac{1}{4}$	$20\frac{1}{4}$						
5	Philad'a., Germantown, Norristown,	Philadelphia to Germantown & Norristown.	1837	$20\frac{1}{4}$			$20\frac{1}{4}$	40 lbs.	8 locomot's				
6	Philadelphia & Reading,	Philadelphia to Mt. Carbon.	1839	$54\frac{1}{2}$	15	$32\frac{1}{2}$	102	45 lbs.	7 "	2.976.000	1.614.000	4.590.000	45.000
7	Philadelphia & Trenton,	Philadelphia to Trenton.	1833	30			30	$2\frac{1}{4}\times\frac{5}{8}$	5 "	400.000		400.000	13.333
8	Philad. & Wilmington,*	Philadelphia to Wilmington.		28			28	$2\frac{1}{4}\times\frac{5}{8}$	4 "	500.000		500.000	17.857
9	Harrisburg & Lancaster,	Harrisburg to Lancaster.	1837	36			36	$2\frac{1}{4}\times\frac{5}{8}$	8 "	860.000		860.000	23.900
10	Cumberland Valley,	Harrisburg to Chambersburg.		46			46	$2\frac{1}{4}\times\frac{5}{8}$	8 "				
11	Franklin,	Chambersburg to Williamsport.	1839	$10\frac{1}{2}$	6	$7\frac{1}{2}$	24		1 "				
12	York & Wrightsville,	York to Wrightsville.			13		13	58 lbs.					
13	Mauch Chunk,	Mauch Chunk to Coal Mines.	1827	9			9	$2\times\frac{1}{2}$	mules	100.000		100.000	11.110
14	Room Run,	Near Mauch Chunk to Mines.	1833	5			5	$2\times\frac{1}{2}$	mules	150.000		150.000	30.000
15	Beaver Meadow,	Beaver Meadow to Parryville.	1836	26			26	$2\frac{1}{4}\times\frac{5}{8}$	6 locomot's	360.000		360.000	13.846
16	Hazleton Branch,	Hazleton to Beaver Meadow R. R.	1838	10			10	$2\frac{1}{4}\times\frac{5}{8}$	3 "	120.000		120.000	12.000
17	Sugar Loaf Summit,	Branches to Beaver Meadow.	1839	2	2		4	$2\frac{1}{4}\times\frac{5}{8}$	1 "	30.000	10.000	40.000	10.000
18	Buck Mountain,	Buck Mountain Coal Mines to Lehigh.			$4\frac{1}{3}$		$4\frac{1}{3}$	38 lbs.		100.000		100.000	23.077
19	Susquehanna & Lehigh,	Wilkesbarre to Whitehaven.			$20\frac{1}{2}$		$20\frac{1}{2}$	57 lbs.		600.000	400.000	1.000.000	48.785
20	Little Schuylkill,	Port Clinton to Tamaqua.	1831	22		7	29	2×0.44	5 locomot's	400.000	100.000	500.000	17.241

* The Philad'a and Wilmington Rail-road now forms a part of the Philad'a, Wilmington, and Baltimore Rail-road; the whole of which has cost $4.400.000.

Rail-roads completed and in progress in the State of Pennsylvania—Continued.

No.	Name of Rail-road.	From and to where.	Opened.		No. Miles		Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital aready expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
			Year.	Miles.	besides graded.	not yet c'nstr'd							
							miles			Dollars.	Dollars.	Dollars.	Dollars.
21	Little Schuylkill & Susquehanna,	Catawissa to Little Schuylkill R. R.			39		39	50 lbs.		850.000	1.000.000	1.850.000	36.275
22	Beaver Meadow Extension,	Little Schuylkill & S. R. R. to Beaver Meadow R. R.			12		12	50 lbs.					
23	Schuylkill Valley,	Port Carbon to Tuscarora.	1830	10			10	$1\frac{1}{2}\times\frac{3}{8}$	horses	65.000		65,000	6.500
24	Mill Creek,	Port Carbon to Coal Mines.	1830	5			5	$1\frac{1}{2}\times\frac{3}{8}$	horses	45.000		45.000	9.000
25	Branches to both,	From different mines.		12			12	$1\frac{1}{2}\times\frac{3}{8}$	horses	54.000		54.000	4.500
26	Mount Carbon,	Mount Carbon to Minehill.	1831	7			7	$2\frac{1}{4}\times\frac{5}{8}$	horses	118.000		118.000	16.857
27	West Branch,	Schuylkill Haven to Minehill and branches.	1831	18			18	$7\frac{1}{2}$&35 lbs.	horses	315.450		315.450	17.525
28	Pottsville & Danville,	Pottsville to Sunbury.	1838	$29\frac{1}{2}$	3	10	$42\frac{1}{2}$	$2\times\frac{1}{2}$&$2\frac{1}{4}\times\frac{5}{8}$	2 locomot's	670.000	200.000	870.000	20.470
29	Williamsport & Elmira,	Williamsport to Pennsylvania State line.	1839	25	1	41	67	$2\frac{1}{2}\times\frac{3}{4}$	1 "	437.000	903.000	1.340.000	20.000
30	Blossburg & Corning,	Blossburg to Penn. State line.			$25\frac{3}{4}$		$25\frac{3}{4}$	$2\frac{1}{4}\times\frac{3}{4}$	2 "	250.000		250.000	9.709
31	Carbondale,	Carbondale to Honesdale.	1829	$16\frac{1}{2}$			$16\frac{1}{2}$	$1\frac{1}{2}\times\frac{1}{2}$&$2\frac{1}{4}\times\frac{1}{2}$	horses and stat'n'ry eng	300.000		300.000	18.182
32	Pine Grove,	Union Canal to Coal Mines.	1830	4			4		horses				
33	Lykens Valley,	Millersburg to Bear Gap Mines.	1830	$16\frac{1}{2}$			$16\frac{1}{2}$		horses				
34	Bear Creek,	Pottsville & Danville R. R. to Coal Mines.			2	2	4						
35	West Philadelphia,	Philad'a. & Columbia R. R. to river Schuylkill.			8	2	10						
36	Philadelphia,*	Within the city of Philad'a.		6			6	$2\frac{1}{4}\times\frac{5}{8}$	horses				
				$576\frac{1}{2}$	$161\frac{1}{2}$	$112\frac{1}{4}$	$850\frac{1}{4}$		114 l'com't's				

* The rail-roads in Philadelphia are:—the City Rail-road, $2\frac{1}{4}$ miles; N. Liberties and Penn Township, $1\frac{1}{4}$ mile; Southwark Rail-road, with branch, $2\frac{1}{2}$ miles.

1. In the whole there are 40 different rail-road lines in the State of Pennsylvania, 2 of which were constructed by the State, and 38 by private companies. The longest continuous line of rail-road now in operation in the State, is that from Philadelphia to Greencastle, a distance of 163 miles; and the total length of rail-roads, which were in use at the close of 1839, is 576½ miles; there were besides 161½ miles nearly completed, and 112¼ miles to be constructed, making the total length of all the rail-roads in the State, when completed, equal to 850¼ miles.

2. The number of locomotive engines employed for the transportation of passengers and freight in the State of Pennsylvania is 114; they run upon 16 rail-roads with an aggregate length (in operation) of 485 miles, being 1 locomotive engine for 4¼ miles of rail-road. In some of these rail-roads stationary steam-power is also applied.

3. The above statement contains the amounts already expended on 26 rail-roads, and their ultimate total cost; of the other roads the exact amounts have not been ascertained. If we compare the length of these 26 rail-roads, which is 686¼ miles, with their total cost of $19.867.450, we find the average cost per mile $28.950. At a fair estimation, the amount already expended on those works, not comprised in the above 26, and being 164 miles in extent, may be put down at $2.410.000, and their ultimate cost at $3.-200.000, we then have:

Total amount expended for rail-roads in Pennsylvania, . .	$18 050.450
Amount yet to be expended on works under construction, . .	5.017.000
Total cost of all the rail-roads, when completed, . .	$23.067.450
And the average cost per mile, " "	. 27.130

Rail-roads in Virginia, North Carolina, South Carolina, Georgia, and Florida.

The rail-roads in these States are nearly all of a light and cheap construction. They traverse sections of country only very thinly settled yet, and therefore command a very small traffic in the transportation of passengers as well as merchandise. It is, however, a particular advantage to these rail-roads that they form a better system than those in the other States, being nearly all connected together, and forming a great thoroughfare through a large portion of the Union; wherefore they are used by the travellers from the North and North-west to the South and South-west, as also for the conveyance of the great Southern Mail. A continuous, uninterrupted line of rail-road, now exists from Fredericksburg in Virginia, to Wilmington, North Carolina, in the one, and to Raleigh, North Carolina, in the other direction; the former having a length of 304, the latter of 227½ miles. Within a short period, other lines of similar length will be completed.

The *Rail-roads in Virginia* have all wooden superstructures with flat iron bars of small dimensions (generally ½ inch in thickness.) Their grades, however, are very moderate, the country being favorable for their location. The State government has taken an active part in the promotion of rail-roads in Virginia, by subscribing for two-fifths of the stock of all works, as soon as the other three-fifths were subscribed by private individuals.

The State of *North Carolina* has now two extensive rail-roads in operation, one of which forms the longest line of rail-road as yet completed by a single company in the United States. The same rail-road has an uninterrupted straight line of 47 miles in length. The width of track of the rail-roads in this State, as well as in the State of Virginia, is 4 feet 8½ inches.

South Carolina was in possession of one of the earliest rail-roads in America; but although this was completed in 1833, no other rail-road has been undertaken, except the branch to Columbia, which forms the first section of the intended Louisville, Cincinnati, and Charleston rail-road.

The *Rail-roads in Georgia*, though but lately commenced, are beginning to class amongst the most extensive and important. When completed they will form a system by which the whole State must be benefited. One rail-road is constructed by the State, the other lines were undertaken by private companies, to whom banking privileges are granted, in order better to enable them to raise the necessary capital, as also to realise a larger profit by the assistance of banking operations. The rail-roads are substantially built, partly with plate rails, and partly with the heavy T rail.

The *Territory of Florida*, with its small population, is not devoid of rail-roads; they are confined, however, to the western section of the country, where now three rail-roads with an aggregate length of 60 miles, are in operation. They were constructed by private companies. A fourth rail-road, extending into the State of Alabama, has been commenced, but the works on it are at present suspended.

The rail-roads in Georgia, South Carolina, and Florida, have all a clear width of track of 5 feet.

The following list of the rail-roads in the five States enumerated, has been compiled from data collected during the summer of 1839. Corrections have been made concerning those works which have since been progressing, so that this table represents the different works in the state they were in at the close of the year 1839.

Rail-roads completed and in progress in the States of Virginia, North and South Carolina, Georgia, and Florida Territory.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Richmond, Fredericksburg, and Potomac,	Richmond to Fredericksburg and the Potomac.	1837	61½		14	75½	plates 2¼×½	12 locomot's	1.200.000	250.000	1.450.000	19.205
2	Richmond & Petersburg,	Richmond to Petersburg.	1838	22½			22½	" 2×½	5 "	700.000		700.000	31.111
3	Louisa,	Richmond, Fredericksburg, & Potom'c r. r. to Gordonsv'le.	1838	35	14		49	" 2¼×⅝	*	415.000		415.000	8.470
4	Richmond & Coal Mines,	Richmond to the Mines.	·	12			12	" 2×½	*	100.000		100.000	8.333
5	Chesterfield,	Manchester to Coal Mines.	1831	13			13	" 2×½	horses	200.000		200.000	15.385
6	Petersburg and Roanoke,	Petersburg to Blakeley.	1833	60			60	" 2×½	12 locomot's	766.000		766.000	12.767
7	City Point,	Petersburg to City Point.	1838	9			9	" 2×½	1 "	210.000		210.000	23.333
8	Greensville and Roanoke,	Petersburg and Roanoke R. R. to Gaston.	1838	17⅔			17⅔	" 2×½	*	260.000		260.000	14.717
9	Portsmouth & Roanoke,	Portsmouth to Weldon.	1837	78⅓			78⅓	" 2¼×½	7 locomot's	850.000		850.000	10.851
10	Winchester and Potomac,	Winchester to Harper's Ferry.	1836	32			32	" 2×½	5 "	500.000		500.000	15.625
1	Experimental,	Raleigh to Stone Quarries.	1833	1½			1½	" 1×¼	horses	3.600		3.600	2.400
2	Raleigh and Gaston,	Raleigh to Gaston.	1840	84½†			84½	" 2×½	*	1.360.000		1.360.000	16.095
3	Wilmington and Raleigh,	Wilmington to Weldon.	1840	161†			161	" 2×⅜	11 locomot's	1.800.000		1.800.000	11.180
1	Charleston & Hamburg,	Charleston to Hamburg.	1833	136			136	25½ lbs.	27 "	2.400.000		2.400.000	17.647
2	Louisville, Cincinnati, & Charleston,	Branchville to Columbia.			50	16	66	56 lbs.		800.000	800.000	1.600.000	23.880
1	Georgia,	Augusta to Madison and branches.	1839	87½	70	54	211½	2.4×0.8,46 lbs	10 "	2.178:000	1.000.000	3.178.000	15.026
2	Central,	Savannah to Macon.	1840	100†	30	63	193	2½×¾&32 lbs.	4 "	1.280.000	1.020.000	2.300.000	11.917

* The locomotive engines used upon these rail-roads belong to other Companies, with whom agreements were made for the purpose.

† These distances stated as opened, were completed early in 1840.

Rail-roads in Virginia, North and South Carolina, Georgia, and Florida—Concluded.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
3	Monroe,	Macon to Weston & Atlantic R. R.	1839	24	20	52	96	$2\frac{1}{4}\times\frac{5}{8}$	3 locomot's	600.000	900.000	1.500.000	15.625
4	Western and Atlantic,	Decatur to Ross' Landing.			100	40	140			1.400.000	1.400.000	2.800.000	20.000
1	Tallahassee,	Tallahassee to St. Marks and Port Leon.	1837	22	2		24	$2\frac{1}{4}\times\frac{1}{2}$	2 "	200.000		200.000	8.333
2	St. Joseph and Lake Wimico,	St. Joseph to Bayou Columbus.	1836	8			8	$2\frac{1}{4}\times\frac{1}{2}$	2 "	120.000		120.000	15.000
3	St. Joseph and Iola,	St. Joseph to Iola.	1839	$28\frac{1}{2}$			$28\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	1 "	500.000		500.000	17.544
4	Alabama, Florida, & Georgia.	Pensacola to Montgomery.‡			15	$141\frac{1}{2}$	$156\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	2 "	600.000	2.400.000	3.000.000	19.169
23				994	301	$380\frac{1}{2}$	$1675\frac{1}{2}$		104 locom's	18.442.000	7.770.000	26.212.000	15.644

‡ Only about 40 miles of this rail-road are in Florida, the remainder in Alabama.

From this statement the following table is extracted, showing the number of miles of rail-roads undertaken and completed, as also the capital expended, and the whole cost of the rail-roads in each of the five States:

Name of State.	No. of Rail-roads.	No. miles in operation.	Total length of roads.	No. of locomotives.	Amount of capital expended.	Am't necessary for completion.	Total cost of Rail-roads.	Average cost per mile.
Virginia, . .	10	369	341	42	\$5.201.000	\$250.000	\$5.451.000	\$14.772
North Carolina, .	3	247	247	11	3.162.000		3.163.000	12.806
South Carolina, .	2	202	136	27	3.200.000	800.000	4.000.000	19.802
Georgia, . .	4	$640\frac{1}{2}$	$211\frac{1}{2}$	17	5.458.000	4.320.000	9.778.000	15.266
Florida Territory, .	4	217	$58\frac{1}{2}$	5	1.420.000	2.400.000	3.820.000	17.604
	23	$1.675\frac{1}{2}$	994	102	\$18.442.000	\$7.770.000	\$26.212.000	\$15.644

The number of locomotives in use upon 994 miles of rail-roads is only 102, being at an average one locomotive engine for every $9\frac{3}{4}$ miles of rail-road, a circumstance which serves to indicate comparatively small traffic upon these roads. But the last column in this table at the same time shows that the cost of the construction of these rail-roads is smaller in proportion, so that a moderate income will suffice to give a good interest on the capital invested. It must also be remarked that the charges for transportation are higher in the southern than in the northern States.

The average cost per mile of all the 23 rail-roads when completed, will be $15.644, according to the estimates of the engineers, which in some cases may be exceeded; but even if a sufficient allowance be made for this, the average cost per mile will not rise over $16.000.

Rail-roads in Alabama, Louisiana, Mississippi, Tennessee, and Kentucky.

The rail-roads in these five States also pass more or less through sections of country very thinly settled, and are with some exceptions of a less substantial construction, and with the limited means of the companies, the time of their completion may yet be far distant.

The rail-roads undertaken in *Alabama* appear very extensive, if the small population of this State be taken into consideration. Only one of the lines, however, that from Decatur to Tuscumbia, has been opened.

The rail-roads in *Louisiana* are all very short, with the exception of the New Orleans and Nashville rail-road; they nearly all terminate at some point on the Mississippi river, and like the rail-roads in the adjoining State of Mississippi, form lateral branches to this great highway of the West.—To some of the rail-road companies in Louisiana, loans were granted by the State, while others have obtained bank charters.

In *Mississippi* the rail-roads are constructed at a considerable expense by companies with banking privileges. The longest line is that from Natchez to Canton.

Two rail-roads are in progress in the State of *Tennessee*, but no part of them has yet been opened; and in *Kentucky* only 32 miles of rail-roads are in operation. In the latter State a considerable sum has been expended for the improvement of rivers, turnpike roads, and the Louisville and Portland canal.

The rail-roads in *Alabama* and *Louisiana* have not an uniform width of track; on most, however, it is 4 feet $8\frac{1}{2}$ inches. The New Orleans and Nashville rail-road has a clear width of 5 feet 6 inches. The width of track of the railroads in *Mississippi* is 4 feet 10 inches.

Rail-roads completed and in progress in the States of Alabama, Louisiana, Mississippi, Tennessee, and Kentucky.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet constr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
1	Montgomery and West Point,	Montgomery to West Point.			65	20	85	plates $2\frac{1}{2}\times\frac{5}{8}$		200.000	700.000	900.000	10.590
2	Wetumpka and Coosa,	Wetumpka to Fort Williams.			35	21	56	"		50.000	566.000	616.000	11.000
3	Selma and Tennessee,	Selma to Gunters' Landing.			27	143	170			80.000	1.570.000	1.650.080	9.700
4	Cahawba and Marion,	Cahawba to Marion.			27		27			50.000			
5	Linden and Demopolis,	Linden to Demopolis.			10	12	22			25.000			
6	Mobile and Cedar Point,	Mobile to Cedar Point.	1837	5	4	$17\frac{1}{2}$	$26\frac{1}{2}$	" $2\times\frac{5}{8}$	1 locomot.	117.000	183.000	300.000	11.320
7	Tuscumbia, Courtland, and Decatur,	Decatur to Tuscumbia.		46			46		2 "				
1	Pontchartrain,	New Orleans to Lake Pontchartrain.	1831	$4\frac{1}{2}$			$4\frac{1}{2}$	24&56 lbs.	4 "	356.000		356.000	79.110
2	New Orleans and Nashville,	New Orleans to Mississippi State line.	1839	$22\frac{1}{2}$		66	$88\frac{1}{2}$	$3\times1\frac{5}{8}$	3 "	970.000	800.000	1.770.000	20.000
3	Bath,	New Orleans & Nashville R. R. to Lake.	1837	$1\frac{1}{4}$	2	$2\frac{3}{4}$	6	$2\times\frac{3}{8}$	horses	50.000			
4	Carrolton,	New Orleans to Carrolton.	1837	$7\frac{1}{4}$			$7\frac{1}{4}$	$2\frac{1}{2}\times\frac{3}{4}$	5 locomot's	500.000		500.000	68.965
5	Orleans Street,	In New Orleans.		$1\frac{1}{2}$			$1\frac{1}{2}$	$2\times\frac{1}{2}$	horses				
6	Lake Borgne,	New Orleans to Lake Borgne.	1838	5		20	25	$3\times1\frac{5}{8}$	1 locomot.				
7	Alexandria and Cheneyville,	Alexandria to Cheneyville.	1839	6	10	14	30		2 "				
8	Baton Rouge & Clinton,	Baton Rouge to Clinton.				30	30			16.000			
9	Clinton & Port Hudson,	Port Hudson to Clinton and Jackson.	1839	14	14		28	$2\frac{1}{2}\times\frac{7}{8}$	3 "	400.000	100.000	500.000	17.857
10	West Feliciana,*	Bayou Sara to Woodville.			20	8	28	$2\frac{1}{4}\times\frac{5}{8}$	2 "				
1	Mississippi,	Natchez to Canton.	1839	25	15	100	140	40 lbs.	4 "	1.550.000	1.950.000	3 500.000	25.000

* $7\frac{1}{2}$ miles of this rail-road are in the State of Mississippi.

Rail-roads in Alabama, Louisiana, Mississippi, Tennessee, and Kentucky.—Continued.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
2	Vicksburg and Jackson,	Vicksburg to Jackson.	1839	25	20		45	42 lbs.	4 locomot's	1.600.000	160.000	1.760.000	39.111
3	Jackson and Brandon,	Jackson to Brandon.			12		12			30.000			
4	Raymond,	Vicksburg R. R. to Raymond.			6		6	$2\times\frac{5}{8}$		30.000	20.000	50.000	8.333
5	Grand Gulf & Pt. Gibson,	Grand Gulf to Port Gibson.			7	$\frac{1}{2}$	$7\frac{1}{2}$	50 lbs.					
1	Hiwassee,	Knoxville to Georgia S'te line.			70	27	97						
2	Lagrange and Memphis,	Lagrange to Memphis.			40	10	50	$2\frac{1}{2}\times\frac{5}{8}$		200.000	300.000	500.000	7.874
3	Sommerville Branch,	Lagrange & Memphis R. R. to Sommerville.			10	$3\frac{1}{2}$	$13\frac{1}{2}$	$2\frac{1}{2}\times\frac{5}{8}$					
1	Lexington and Ohio,	Lexington to Portland.	1835	$30\frac{1}{2}$	27	37	$94\frac{1}{2}$	$2\frac{1}{4}\times\frac{5}{8}$	2 locomot's	935.000	1.250.000	2.185.000	23.122
2	Portage,	Bowling Green to Barren riv.	1837	$1\frac{1}{2}$			$1\frac{1}{2}$	$2\frac{1}{4}\times\frac{5}{8}$	horses	12.000		12.000	8.000
27				195	421	$532\frac{1}{4}$	$1148\frac{1}{4}$		33 locomot's				

This statement does not contain the cost of every rail-road in progress, and the amount which has already been expended, because of some it was difficult to obtain correct data, on account of the lines being located in remote parts of the States, while others have yet made very little progress, and their ultimate cost is therefore hardly known. In the following table, which contains the aggregates for each State, the deficiencies were made up by estimates founded upon a knowledge of the nature of the works and their plan of construction.

Name of State.	No. of Rail-roads.	No. miles in operation.	Total length of roads.	No. of locomotives.	Am'nt of capital expended.	Am't necessary for completion.	Total cost of Rail-roads.	Average cost per mile.
Alabama, . .	7	51	$432\frac{1}{2}$ miles.	3	$1.222.000	$3.434.000	$4.656.000	$10.763
Louisiana, . .	10	62	$248\frac{3}{4}$ "	20	2.862.000	1.834.000	4.696.000	18.880
Mississippi, . .	5	50	$210\frac{1}{2}$ "	8	3.490.000	2.240.000	5.730.000	27.221
Tennessee, . .	3		$160\frac{1}{2}$ "		1.100.000	855.000	1.955.000	12.180
Kentucky, . .	2	32	96 "	2	947.000	1.250.000	2.197.000	22.885
	27	195	$1148\frac{1}{4}$ miles	33	$9.621.000	$9.613.000	$19 234.000	$16.750

It appears that there are 27 rail-roads in the above five States, of which only 195 miles are completed and in operation, while their total length, when finished, will be 1148 miles. 33 locomotive engines are used upon 195 miles of roads, which gives one engine for 6 miles; the greatest number of locomotives is upon the Pontchartrain rail-road, that is, 5 for 7½ miles, or 1 for 1½ miles of road.

Of the total cost of the rail-roads, which will be $19,234,000, one-half has already been expended, and only one-sixth of the whole length is in operation. This shows that the works on many rail-roads must have been suspended, when they were already far progressed. The average cost of the rail-roads in these five States will be $16,750 per mile, which does not differ much from the cost of the rail-roads in Virginia, North and South Carolina, Georgia, and Florida.

Rail-roads in Ohio, Indiana, Michigan, and Illinois.

Ohio has early embarked in a system of internal improvements, but following the example of the State of New York, has chosen canals to form the artificial lines of internal communication through this large State. Several rail-roads were long afterwards undertaken by private companies, whom the State assists by guaranteeing loans to the amount of one-third the cost of the works. Passing through a flat country, and intended to accommodate only a small traffic, the rail-roads in Ohio are constructed on a cheap plan, but are nevertheless progressing very slowly, owing to the difficulty of providing the necessary funds. For the Ohio rail-road, which is to extend along the shore of Lake Erie, a width of track of 7 feet has been adopted: the other rail-roads have the usual width of 4 feet 8½ inches.

In *Indiana* the internal improvements are, like the canals in Ohio, undertaken at the expense of the State, and consist in a system of canals, turnpike roads, and one rail-road, leading from the capital of the State to the Ohio river. This rail-road is constructed in a very permanent manner. Another along the northern boundary line of the State has been commenced by a company, but the works were afterwards suspended for want of capital.

Michigan, though one of the youngest States, will soon have all the settled parts of the country traversed by rail-roads, which are partly constructed by the State and partly by private companies. The country is very favourable for the location of rail-roads, and they are therefore executed at a very moderate cost.

The system of rail-roads projected in *Illinois* is far too great for the present population, trade, and resources of this young State, and it will be long before all the rail-roads projected and under construction will be completed. Besides the State works, only two rail roads have been undertaken by private companies, one of which has been completed; of the other, the works are suspended. The width of track of the rail-roads both in Michigan and Illinois, is 4 feet 8½ inches.

The data for the following statement has been collected during the months of August and September, 1839, and as very little has been done from that time to the end of the year, the numbers have been left unaltered.

Railroads completed and in progress in the States of Ohio, Indiana, Michigan and Illinois.

No.	Name of Rail-road.	From and to where.	Opened.		No. Miles		Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
			Year.	Miles.	besides graded.	not yet c'nstr'd							
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Mad River & Lake Erie,	Sandusky City to Springfield.	1838	15	30	85	130	plates $2\frac{1}{4}\times\frac{5}{8}$	1 locomot.	155.000	755.000	910.000	7.000
2	Little Miami,	Cincinnati to Springfield.			20	65	85	$2\frac{1}{2}\times\frac{3}{4}$		100.000	900.000	1.000.000	11.765
3	Monroeville & Sandusky,	Monroeville to Sandusky City.	1838	15			15	$2\frac{1}{4}\times\frac{5}{8}$	horses	75.000	15.000	90.000	6.000
4	Cleveland and Newburg City,	Cleveland to Stone Quarries.	1838	6			6	wooden ribbon.	horses	18.140		18.140	3.023
5	Fairport and Painsville,	Fairport to Painsville.	1838	3			3		horses	22.000		22.000	7.333
6	Ohio,	Coneaut to Maumee Bay.			30	147	177	$2\frac{1}{2}\times\frac{3}{4}$		50.000	1.189.000	1.239.000	7.000
1	Madison & Indianopolis,	Madison to Indianopolis.	1839	20	30	40	90	rails 45 lbs.	2 locomot's	1.300.000	2.200.000	3.500.000	38.839
2	Buffalo and Mississippi,	Western to Eastern Boundary of the State.			10	146	156			75.000	1.225.000	1.300.000	8.333
1	Erie and Kalamazoo,*	Toledo to Adrian.	1836	33			33	plates $2\frac{1}{4}\times\frac{5}{8}$	2 "	281.000	19.000	300.000	9.091
2	Palmyra & Jacksonburg,	Palmyra to Jacksonburg.	1838	11	5	30	46	$2\times\frac{1}{4}\frac{5}{8}$	horses	53.000	246.000	299.000	6.500
3	River Raisin and Lake Erie,	Monroe to Lake Erie.	1838	4			4	wooden ribbon.	horses	44.000		44.000	11.000
4	Detroit and Pontiac,	Detroit to Pontiac.	1839	18	7		25	$2\frac{1}{4}\times\frac{5}{8}$	1 locomot.	160.000	40.000	200.000	8.000
5	Shelby and Detroit,	Detroit to Utica.	1839	10		7	17	wooden ribbon.	horses	23.000	17.000	40.000	2.353
6	Ypsilanti and Tecumseh,	Ypsilanti to Tecumseh.			5	19	24			40.000	160.000	200.000	8.333
7	Detroit and Maumee,	Manhattan to Havre.			3		3			15.000	5.000	20.000	6.667
8	Central,†	Detroit to St. Joseph.	1839	38	30	128	196	$2\frac{1}{4}\times\frac{5}{8}$	5 locomot.	800.000	1.552.000	2.352.000	12.000
9	Southern,†	Monroe to New Buffalo.			50	139	189	$2\frac{1}{4}\times\frac{5}{8}$		420.000	1.659.000	2.079.000	11.000
10	Northern,†	Point Huron to Grand Haven.			10	$191\frac{1}{2}$	$201\frac{1}{2}$	$2\frac{1}{4}\times\frac{5}{8}$		60.000	1.955.000	2.015.000	10.000

* 12 miles of this rail-road are in the State of Ohio.

† These 3 rail-roads are State works.

Rail-roads in Ohio, Indiana, Michigan, and Illinois—Continued.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd.	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
1	Central,	Cairo to Galena.			85	365	450	$2\frac{1}{4}\times\frac{3}{4}$		400.000			
2	Northern Cross,	Quincy to State line of Ind'a.	1839	16	100	114	230	"	2 locomot's	785.000			
3	Peoria and Warsaw,	Peoria to Warsaw.			24	92	116	"		140.000			
4	Bloomington and Mackinaw	Pekin to Bloomington.			10	$26\frac{1}{2}$	$36\frac{1}{2}$	"		75.000			
5	Southern Cross,	Alton to Mount Carmel.			30	117	147	"		150.000	14.007.500	15.768.000	12.000
6	Alton and Shawneetown,	South Cross to Shawneetown.			15	130	145	"		75.000			
7	Alton and Shelbyville,	Alton to Shelbyville.			15	93	108	"		45.000			
8	Central Branch,	Shelbyville to State line of Ind.			20	$51\frac{1}{2}$	$71\frac{1}{2}$	"		90.000			
9	Rushville and Erie,	Rushville to Erie.				10	10	"		500			
10	New Pittsburg and Mississippi,‡	Illinois Town to Coal Mines.	1838	7			7	$2\times\frac{1}{2}$	horses	42.000		42.000	6.000
11	Galena and Chicago Union,‡	Galena to Central Rail-road.			4	96	100			30.000	1.170.000	1.200.000	12.000
29				196	533	$2092\frac{1}{2}$	$2821\frac{1}{2}$		13 locomot's	5.523.640	27.114.500	32.638.140	11.568

‡ These two rail-roads are constructed by private companies; all the others are State works.

The following table gives a summary statement of the works in each of the four Western States.

Name of State.	No. of Rail-roads.	No. miles in operation.	Total length of roads.	No of locomotives.	Amt. of capital expended.	Amt. necessary for completion.	Total cost of rail-roads.	Average cost per mile.
Ohio,	6	39	416 miles.	1	$ 420.140	$2.859.000	$3.279.140	$ 7.883
Indiana,	2	20	246 "	2	1.375.000	3.425.000	4.800.000	19.512
Michigan,	10	114	$738\frac{1}{2}$ "	8	1.896.000	5.653.000	7.519.000	10.222
Illinois,	11	23	1421 "	2	1.832.500	15.177.500	17.010.000	11.970
	29	196	$8221\frac{1}{2}$ miles.	13	$5.523.640	$27.114,500	$32 638.140	$11.568

Of the 29 rail-roads in the States of Ohio, Indiana, Michigan, and Illinois, only 196 miles have been completed and put into operation; of these, 56 miles are used with horse power, and 140 miles with locomotive engines; each locomotive serves, therefore, for 11 miles of rail-road. When all the rail-roads projected and commenced in the above four States will be completed, their aggregate length will be 2,821½ miles.

The total amount already expended on all the 29 rail-roads is $5,523,640, and near 5 times as much, or $27,114,500, will be required, according to the estimates, to complete the works; the total cost being estimated at $32,638,-140, or only at $11,568 per mile at an average. This cost appears very low compared with that of other rail-roads; but with the experience already acquired in the construction of these kind of works, and where the country offers so few obstacles to their location, there is no doubt that rail-roads with wooden superstructure and plate rails may be executed for the sum of $12.-000 per mile.

Franklin Institute.

Report on Mr. L. Phleger's Spark Arrester.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an apparatus for arresting sparks issuing from the flues of locomotive engines, invented by Mr. L. Phleger, of Philadelphia, Penn., Report :—

That they have examined this apparatus, and witnessed its operation on some of the engines of the Philadelphia and Baltimore Rail-road, where it has been on trial for several weeks.

It consists of several parts, the arrangement of which will be described with as much detail as is essential to the object of this report. Around the smoke-pipe of the engine which is of the usual form and dimensions, is placed a case of sheet-iron perforated with some thousands of small holes, resembling those of a fine nutmeg grater with the burr turned inwards. This case is sufficiently large to leave a space of two inches width between it and the smoke-pipe, and rises several inches above the top of the pipe: it is closed at the top by an inverted conical cap of thin cast iron, which is fixed on a hinge and furnished with a lever and rod, by which it may be raised out of the way when the fire is first kindled, for getting up steam. Outside of the perforated case just described is a second casing of sheet-iron, not perforated, but furnished with twelve out-let pipes about six inches diameter, six of which pass out at its base, and after two bends, or elbows, are again inserted at its top: the other six are similarly inserted at the top of the outer case, but have their lower insertion within about 12 or 15 inches of the top.

The annular chamber between the two cases, is open at the top for the ultimate escape of the smoke and vapour.

When the smoke and cinders are thrown up the smoke-pipe by the power of the exhaust, they strike against the conical cap which closes the top of the perforated case, and rebound into the annular space between it and the enclosed pipe, with great velocity. The smoke and other gases from their small momentum, soon lose a part of their downward motion and are forced out through the numerous perforations, which present an aggregate area of

passage much greater than the section of the smoke-pipe, and thus give free vent to the gases. The cinders having a greater density are carried downward by the joint effect of their momentum and gravity, until they are beyond the effect of the exhaust, and are finally shaken by the motion of the engine into an iron receptacle connected with the annular space in which they have been deposited.

The smoke and steam, with some of the fine particles of dust, having passed through the perforated case, enter the annular chamber between the two cases, and are mostly carried to the bottom of this by the portion of their directive force which they retain. From this they escape by the six longer out-let pipes described as proceeding from the base of the chamber and are given out at the top of the chimney; the small sparks, if any escaped through the perforated case, having been extinguished, or deposited in the circuitous course through which they must travel.

This circumstantial statement of the action of the apparatus is given, because at first view of it not much confidence was placed in the probable result; but repeated trials having proved its complete efficiency, it was deemed worth while to examine minutely into the mode of its operation, and give a brief description of it in this report.

The trials in the presence of the Committee were made under a variety of circumstances, well calculated to remove all uncertainty of the entire correctness of their observations. On the first occasion they traveled behind the engine from Elkton to Gray's Ferry, a distance of 45 miles, entirely after night. On the journey down to Elkton they were conveyed by an engine provided with a spark arrester of some other form, whose it was they did not learn, but it may suffice to say of it, that the route was enlivened after night-fall, by a copious shower of brilliant cinders, which were scattered many yards to the lee side of the road, notwithstanding a heavy rain which was falling at the time.

On returning with the apparatus which is the subject of report, they were agreeably surprised to find that while the engine was running with the fire door closed, not a single spark made its appearance. When the engine was standing, or when the fire-door was opened, a few sparks were seen to escape, but their number was so small as to be easily counted, and they were so light that they were extinguished, or burned out before passing half across the road. A subsequent trial was made in the presence of some members of the Committee, when both engines, going, and returning, were furnished with this apparatus, so as to give an opportunity of witnessing its effect by day and by night; the result on this occasion was equally satisfactory as on the former.

As the Committee have had some experience of the operation of spark arresters, and have generally found, heretofore, that they were efficacious only in proportion as they impeded the fire draught, it was deemed important to inform themselves particularly on this point, in the present case. On enquiry of the engineers who are using the apparatus, they agreed in asserting that the engines made steam quite as well with it as without, and some of them supposed even better. The engines used on these trials were drawing their usual train on a full trip, and certainly made abundance of steam, blowing off during a considerable part of the trip; and an examination of the fire when the furnace door was opened, showed that the effect of the exhaust was not perceptibly diminished.

In conclusion, the Committee feel entirely free to state their conviction, that the experiments witnessed by them were completely successful, and if

farther trials made with heavy trains shall give similar results, and the apparatus is not found to become impaired in its efficiency, by the choking up of the perforations, as has been the case with some others in which the perforated sheet has been used, they believe it will constitute the long-sought desideratum of an efficient machine which completely removes all danger and inconvenience from the chimney sparks, while it does not sensibly diminish the power of the engine.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

August 13, 1840.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JULY, 1839,

With Remarks and Exemplifications by the Editor.

1. For *Hanging Scythes;* Ebenezer G. Samson, Shelburn, Franklin county, Massachusetts, July 2.

A considerable number of patents have been granted for this mode of attaching scythes to their snaths, and no doubt the manner of effecting this has been much improved; but the wedges, keys, or rings, by which it is effected are not matters to be spread forth on our pages, as without a cut they would not be rendered intelligible; the claims in the present case are to the particular manner in which a hook, a bolt, and a claw, are used, to accomplish the desired object.

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2. For *Coffins made of Cement, &c.;* Moses Leonard, Syracuse, Onondaga county, New York, July 2.

The claim is to the making of coffins of a resinous cement which is to be poured into moulds properly constructed, there being cores of thin boards, perforated, or formed of slats, in such a manner as to cause the cement to bind perfectly, and also to cover the edges of the wood completely. The particular manner of forming these moulds is also claimed.

"My cement, or composition, I make as follows:—I take rosin, beeswax, and pulverized stone, which I incorporate intimately by heat. The stone may be limestone, marble, granite, or any other of a suitable hardness and texture; the pulverized stone I prefer to make of different degrees of fineness, from that of corn-meal, to that of grains of buckwheat. To five pounds of rosin and one of beeswax, I add about thirty pounds of the pulverized stone, first melting the rosin and beeswax in an iron vessel over a fire, and stirring in the pulverized stone, previously sifted; and these ingredients in their proportions, or nearly so, will constitute a cement, or bituminous artificial stone which, whilst it may be fused and cast into moulds, will, when cold, be extremely hard and tough, and perfectly impervious to air and moisture."

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3. For an improvement in *Coffee Mills;* John Rittenhouse, Germantown, Philadelphia county, Pennsylvania, July 2.

The kind of mill on which this improvement is made is the common box-mill, with a conical nut and shell, and the design of the improvement

is to confine the nut in such a manner as shall prevent the danger of the teeth of the nut and shell coming into contact with each other. For this purpose the pin of iron that forms the step in which the spindle of the nut runs, is to be made in the form of a cross, and notched on to the shell, which will prevent its shifting in either direction. The claim is to the "so forming such a step as that it shall have three or more distinct points of bearing; or bear upon the whole, or the larger portion of the lower edge of the hollow cone, or shell, the bearings being so notched, or formed, as to check all lateral motion."

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4. For a *Smut Mill;* Elisha W. and W. B. Young, Parkman, Geauga county, Ohio, July 2.

In this smut machine there is a revolving wheel, or a vertical shaft, which wheel consists of two pieces of plank, about two feet six inches in diameter, and standing at a distance of three inches apart. Numerous rods of iron extend from one to the other of these planks, and the grain is fed in between them, through an opening in the centre of the upper plank, and by the centrifugal force given to the wheel the grain strikes against these rods, and against a perforated sheet-iron curbing which surrounds the wheel. Below the lower plank there are cones to create a blast to aid in the cleaning. The grain falls down and is discharged through a funnel-formed hopper below. The claim is to "the wheel constructed as described, in combination with the perforated screen."

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5. For *Separating Burrs from Wool;* Henry Conklin, Poughkeepsie, Dutchess county, New York, July 6.

This machine consists, principally, of a large iron roller which may be of cast-iron, six inches in diameter and 15 inches long; of certain small rollers, called pinching rollers, which are borne together in pairs, and hold the wool between them and the larger roller; and of a plate of metal called a detainer, one edge of which is nearly in contact with the large roller, its office being to detain, or keep back, the burrs from passing; there are also plates of tin, the edges of which rest upon the rollers, to prevent the lapping of the wool around them. The claim is to "the combination of the longer roller, the detainer, and the finishing rollers, constructed and operating substantially as set forth."

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6. For a *Cheese Press;* Odin Gauntt, Springfield, Burlington county, New Jersey, July 6.

In this press the gravity of the cheese to be pressed is made the operating power, as in some other presses for the same purpose; but the parts are arranged differently in the press before us, and this difference becomes the foundation of the claim. The cheese rests upon a platform, which is a follower, and makes a part of a sliding frame which rises and falls between the cheeks of the press. The arrangement is not made known by the claim, nor could this be done without the drawings.

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7. For a *Wire Tiller Rope;* Isaac McCord, Harrisburg, Dauphin county, Pennsylvania, July 6. (See specification.)

8. For a *Door Latch;* Henry Duntze, New Haven, Connecticut, July 6.

A peculiar arrangement of the spring-bolt, follower, friction roller, and spiral spring has been made by the patentee, and no doubt constitutes a good spring-latch; but it is less simple than many others, while we see nothing to render it superior to them. The claim is to "the follower, provided with a friction roller, in combination with the bolt and tumbler, as described."

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9. For a machine for *Manufacturing Crackers and Biscuits;* Benjamin F. Mason, Kennebunk Port, York county, Maine, July 6.

"In this machine the flour and water, with such other materials as may enter into the composition of the crackers, or biscuits, are put into a suitable mixing apparatus, or dough-maker and brake, in which they are thoroughly intermingled, made into dough, and the dough properly broken; from this apparatus said dough is delivered into a hopper, and thence conducted between pairs of rollers, by which it is rolled out to the desired thickness. It is then cut into square or other formed biscuits, by the aid of a cutting roller, and also at the same time pricked, or perforated with holes. By this cutting roller and its fellow, or antagonist roller, the biscuits are delivered on to an endless, revolving, iron apron, by which they are carried into and through a perpetual oven, kept heated by suitable furnaces; in their passage through which oven they are baked and ready to be packed for use."

It will be seen by the foregoing announcement of the general plan and object of this machine, that the whole series of operations concerned in the making of biscuits, is to be simultaneously carried on by it. Many of the individual parts are necessarily similar to such as have been used, but they appear to be combined and arranged with much skill; and if the baking and other operations can be all performed with corresponding speed, we see no reason why the apparatus should not effect the intended purpose advantageously.

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10. For a *Carriage Brake;* Cyrus Walker, Lewisburg, Greenbrier county, Virginia, July 8.

This brake is to operate by forcing a friction bar against the hind wheels of a carriage, the foot of the driver being placed upon a treadle for that purpose. The affair does not present a large amount of novelty, but it differs from other brakes in the particular arrangement of the rods and levers, and this constitutes what is claimed.

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11. For *Metallic Hubs for Carriages;* George Hunt, Prattsville, Greene county, New York, July 8.

The claim under this patent is to "the mode of securing the pipe box of the hub to the arm of the axletree, by means of a band attached to the flanch of the axletree, embracing the flanch on the pipe box, as described."

On the inner end of the box there is a projecting flanch, or rim, which comes nearly into contact with the shoulder, on the head of the axle. The band mentioned in the claim is fastened to the head of the axle by a screw bolt, and a flanch, or fillet, on the interior of this band, embraces the shoulder on the box, and holds it in place, leaving it free to revolve.

12. For a machine for *Drilling Iron, Brass, &c.;* J. H. Currier and W. H. Taber, Fairhaven, Bristol county, Massachusetts, July 8.

A mandrel carrying the drill, works in collars within which it can slide back and forth horizontally. A lever of the first kind is attached to an upright rising from the bore of the machine, the lower end of which is received between two collars on the mandrel, so that by the motion of the lever the mandrel may be moved in either direction. A screw passes through the upper end of the lever, and is tapped into the upright, but not into the lever, within which it turns freely, having a shoulder that bears against it. There is a hand wheel on the head of this screw, by which it may be turned, and a winch on the back end of the mandrel, by which it, also, may be made to revolve. This constitutes the whole machine, which may be affixed to a bench, or held in a vice. The claim is to "the method of forcing in and drawing out the drill stock, lever, and screw, in the manner described." There is, we suppose, sufficient novelty in this arrangement, but we do not think the plan an improvement on several other machines which we have seen in operation.

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13. For an improvement in the machine for *Cutting Shingles, &c.;* Jonathan Burt, Sullivan, Madison county, and Erasmus Smith, Norwich, Chenango county, New York, July 9.

The claim is to "the manner in which we have constructed and combined the parts by which the stuff to be cut is fed up to the knife, and canted so as to produce shingles of the proper slope;" which method is particularized, but is much too complex for verbal description. It is managed with much ingenuity, and will probably operate well. The shingles, &c., are to be cut from steamed timber.

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14. For a *Truss for Hernia;* William B. Day, Village of Hope, Warren county, New Jersey, July 9.

"I use a steel spring to pass around the body, and to sustain the pads, as in many other trusses; but this spring, instead of passing around below the hips, is to pass around above them, and is to be furnished with a pad at each end, one of which pads is to press upon the back, and the other upon the abdomen, thus bearing upon parts where a considerable degree of pressure can be borne with much greater ease and convenience than in the ordinary mode of constructing and using spring trusses.

"To the metallic plate which forms the exterior of one of these pads, a second spring is attached, which descends down therefrom, and has a third pad on its lower end, which third pad is the hernial, or rupture, pad, by which the pressure is to be exerted, which is to retain the intestines in place."

Claim. "What I claim as my invention is the manner in which I have combined the back, the abdominal, and the rupture pads with each other, so as to constitute an instrument essentially new in its leading characteristics; that is to say, the abdominal and back pads being attached by a single screw, or joint pin, to the opposite ends of a spring which is to pass around the body above the hips, and the rupture pad being placed at the lower end of a spring descending from the abdominal, or the back pad, as the case may be, said second spring being made adjustable on the plate to which it is attached, in the manner, and for the purpose, set forth."

15. For a *Corn Sheller*; William R. Parker, Milton, Sussex county, Delaware, July 9.

The ears to be shelled are to be placed lengthwise in a hopper, beneath which revolves a cylinder, furnished with teeth, and having a groove along it, into which a single ear may fall; this is carried round against a concave, and to a second cylinder similar to the first, by which the shelling is completed. The cylinders are grooved, or channeled, around, so as to appear like a succession of flat wheels, and within these channels there are fingers which operate upon the ear. The particular arrangement of the parts does not admit of ready verbal description; it is certainly novel, and we suppose that the machine will operate well. There are, however, many excellent corn shellers, leaving little to desire in this way. The claims are to the manner of constructing the cylinders, with their channels and grooves, in combination with the hopper and concave.

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16. For *Manufacturing Cordage;* Alfred Hathaway, Boston, Massachusetts, July 9.

This is a machine for twisting and laying cordage of various sizes, and in its general construction and operation, it closely resembles several machines which have been patented here and in England; this resemblance is confessed, but the parts claimed consist in a variety of improved devices for obviating difficulties experienced in all the machines heretofore constructed for the same purpose. There are three sheets of drawing, and ten pages of description and references in the record, which we shall not attempt to epitomize; nor shall we give the claims, as they would not, without the other parts, afford a knowledge of the nature of the invention, or rather of the particular improvements upon which it is founded.

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17. For an improvement in the *Horse Power*; Moses Davenport, Phillips, Somerset county, Maine, July 10.

This patent is taken for a "method of connecting the slats of the endless chain horse power; or in the peculiar power given to the connecting links that may extend up any required distance beyond the surface of such revolving endless chain, to work as cogs into a ratchet wheel of any required diameter." The method of connecting the slats, and of causing a drum, or cog wheel, to carry them round, has been the subject of numerous patents, and in a great number of cases, the advantages of the change patented were not by any means apparent. We do not think it worth while to attempt an explanation of the plan now before us, and the claim is necessarily confined to what is special in this place.

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18. For *Elliptical Steel Carriage Springs*; Franklin Hatch, and Jonathan W. Terry, South Courtland, Courtland county, New York, July 10.

Two bow springs are jointed together at their ends, so as to form the ordinary, so called, elliptical spring, and within these two, other bow springs are placed, with their convex sides towards each other; these are joined together at their middles, whilst their ends bear against the interior of the first named springs.

"What we claim as our invention, and desire to secure by letters patent,

is the addition of two leaves to the inside of the elliptic spring, with the curves reversed, in the manner herein described."

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19. For *Separating Uncorroded from Corroded Lead*; Edward Clark, Saugerties, Ulster county, New York, July 11.

In manufacturing white lead, it becomes necessary to separate the particles of uncorroded lead from that which has been converted into white lead, and this has been found to be a difficult and injurious operation when performed by the means hitherto essayed. The apparatus and process employed by the patentee consist in passing the partially corroded lead on an endless wire or canvas cloth apron, under a whipper, the quick and violent operation of which upon it, separates the carbonate of lead from the metallic lead. The whipper consists of a frame covered with wire cloth, or in some similar manner; this frame is jointed at one end to the frame of the endless apron, and it is worked up and down by cams and springs, so as to operate upon the lead as it passes along on the endless apron. The entire machine is inclosed, to confine the dust, and prevent its deleterious effects. The claim is to "the separation of the corroded parts of the lead from the metal, during the process of manufacturing white lead, by means of the apparatus described, consisting of the endless cloth in combination with the spring whipper."

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20. For a *Plough*; Ebenezer G. Whiting, Racine county, Wisconsin Territory, July 11.

"The nature of my invention and improvement consists in making the mould board straight and flat from the point to about the centre, instead of concave as heretofore, and at this point to cause it to assume a curvilinear figure in the usual or most approved pattern, by which union of the straight and curvilinear surface in the mould board, less power will be required to draw it through the earth, and the sward will be turned over smooth and even, without breaking it into pieces." The claim is to this manner of construction.

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21. For an improved *Cotton Gin;* John Beath, city of Boston, July 12.

A good roller gin for long staple cotton, has long been considered a desideratum, and the attempts to supply it have been numerous. The machine before us is for this purpose, and it contains some new devices intended to aid in the operation. There are vibrating combs employed, which are to operate upon the bolls of cotton as they approach the rollers, the intention of which is to open them a little, not so as to injure the staple, but only to cause its more easy separation from the seed by the action of the rollers. The claims are to a comb, as described, vibrating horizontally, by means of a winding, grooved pulley; and to the combination of what is called a lowering roller, with a second roller; the particular arrangements we cannot undertake to give in our brief notice.

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22. For *Supplying Locomotives with Water*; Stephen Vail, Morristown, New Jersey, July 12.

The following extract from the specification, in which the references to the drawings are, of course, omitted, will furnish a clear idea of the nature of the invention:

"My invention is intended to dispense with the reservoir now used at those stations where locomotive engines are to take in their supply of water, into which the water has, usually, to be pumped by hand, at great labour; and in which, in cold weather, its temperature is frequently reduced considerably below that of ordinary well water. This object I accomplish by applying the power of the locomotive engine to work a pump, or pumps, raising water from a common well, and supplying the tank therewith, by merely driving the locomotive on to the lateral track, where it is to receive its supply of water, and allowing its driving wheels to rest on two friction wheels affixed to a line shaft situated in a pit prepared for that purpose below the track, the peripheries of said friction wheels extending up to the line of the rails, and passing through openings therein, prepared for that purpose. I move the locomotive by means of chains, or other suitable contrivances, so that it shall stand steadily with the peripheries of its driving wheels resting on the above named friction wheels, which, when the steam engine is started, will necessarily drive the friction wheels, the shaft of which has attached to it the apparatus requisite for working the pump, or pumps.

"Having thus fully described the nature and object of my invention, and shown the manner in which the same may be carried into operation, what I claim therein, and desire to secure by letters patent, is the within described mode of working pumps for raising water from wells for the supply of locomotive engines, and which mode of communicating power may also be applied to other useful purposes: that is to say, I claim the placing of friction wheels upon a shaft, below the track of a railroad, in such manner as that the driving wheels of a locomotive engine may be made to rest upon their peripheries, and when set in action by the steam engine, will give motion to said friction wheels, and, consequently, to the machinery attached thereto, substantially in the manner, and for the purpose, set forth."

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23. For machinery for *Twisting Silk*; Oliver Ellsworth, Hartford, Connecticut, July 12.

The improvement here patented consists in "substituting a ring and hook, or querk, in the rim of the bobbin, for the common flier now in use, placed on the top of the bobbin for twisting silk." "I take merely the old bobbin, without the old flier and button, and make, in the upper rim of the bobbin a groove deep enough around the rim to receive a wire; I then make a wire ring in said groove, loose enough to play with perfect ease, and fasten the ends of this wire so as to form a hook, or guide, extending out just enough to receive the silk thread from the bobbin," &c.

"I do not claim the bobbin, the spindle, the ring and hook, or any of the parts separately, as they have long been known. But what I do claim as my invention, and desire to secure by letters patent, is the ring and hook, or querk, in combination with the bobbin, in the manner, and for the purpose described."

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24. For a *Washing Machine*: Samuel Swett, jr., Portland, Maine, July 12.

The clothes to be washed are folded and placed on a frame, which is moved up and down, by means of a lever, between two fluted rubbing boards, borne up by springs, the whole being contained within a suitable box. The

claims made are to the frame for holding the clothes, in combination with the rubbing boards attached to springs. This washing machine differs sufficiently from those which have been previously patented, to sustain its claim, but, probably, like most of them, after being for a short period the tenant of the wash-house, it will be consigned to the cellar or to the garret. If any thing saves it, it will be the fluted washing boards, which have kept their station longer than any of the other members of the fraternity.

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25. For *Vents for Barrels, &c.*; Samuel Pike, Brattleborough, Windham county, Vermont, July 12.

This vent is intended to be self acting, the valve which closes it being opened by the pressure of the atmosphere. It may be said to be in the form of a syphon, with very short legs. The longer leg is furnished with a screw, which screws into the upper side of the barrel; the short leg has a valve within it, which, falling by its own gravity, closes the opening into it. When this is in place, and liquor is drawn from the cask, the pressure of the external air will raise the valve, and air will pass in. The claim is to "a vent for tight vessels, furnished with a valve, which opens by the pressure of the air when the liquor is drawn, and shuts by its own weight when the drawing ceases, constructed in the manner, and for the purposes described."

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26. For *Traps for Catching Animals;* William Biddle, Pittsburgh, Pennsylvania, July 12.

This trap is constructed in a manner bearing considerable resemblance to that patented by Thomas Kell, on the 3rd of March, 1838, and the ends proposed are the same, namely, that the trap, after catching an animal, shall reset itself, or be reset by the animal; that the captured animal may pass along a passage leading to a separate compartment, from which it cannot return, said compartment being so constructed as to be readily detached from the body of the trap. The particular devices, of course, differ from those used in the trap above named, or the present patent would not have been granted. The claims are confined to these particular devices, as referred to by letters on the drawings.

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27. For an improvement in *Windmills;* Wantsford Evans, Dumfries, Prince William county, Virginia, July 12.

Within a room, erected for the purpose, there is to be a vertical shaft, turning on gudgeons, that is to be surrounded by vanes, against which the wind is to blow; on the sides of the building there are doors, that may be opened or closed at pleasure, so to admit, and to allow an exit to, the wind. On the outsides of the doors there are to be wings, or sails, of cloth, or other partitions placed to direct the wind towards the doors.

"The invention claimed consists in the arrangement of the wings and doors for regulating the current of air."

If this is an improvement on windmills, we should be glad to hear what kind of windmill is inferior to it. But, as we have frequently remarked, *improvement* and *alteration* are often synonymous in the vocabulary of patentees. The mill before us will not, we are sure, supersede the old fashioned mill with vertical sails, nor equal some of the horizontal mills, most of which are poor affairs.

28. For *Obtaining Ice*; Joseph E. Manuel, city of Philadelphia, July 12.

"I erect a series of platforms, one above the other, which are to be so constructed as to constitute reservoirs capable of containing water to the depth of six inches, more or less; the floors of these reservoirs are to be made water-tight; their dimensions and number must be determined by the quantity of ice it may be desired to make; their distance apart should be such as will admit of the collecting the ice, and shoveling it into the vertical hollow trunk which leads down from the reservoirs into the ice house, or other receptacle.

"In using these structures, water is to be admitted into the reservoirs in any convenient manner. Where there are waterworks, as in the city of Philadelphia, or where it can be obtained from any source sufficiently elevated, it will, of course, be allowed to flow in spontaneously."

"I claim the erecting and employment of platform reservoirs, in the manner set forth, said reservoirs being placed one above the other, and being made capable of containing water for the production of ice; and in combination with such a structure, I claim the formation and employment of a hollow trunk, through which the ice may be passed from the respective reservoirs into an ice house, or other receptacle."

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29. For a machine for *Mortising, Tenoning, and Boring Timber;* James H. Martin and Barnt Richtmyre, Conesville, Schohairie county, New York, July 16.

Such machines as the above named are capable of almost infinite variation in the manner of forming and arranging their respective parts, and it is altogether out of the question to attempt a brief description of them. The specification before us occupies many pages of record, and contains throughout, references to the drawings; the claims are made by referring to these drawings by letters and numbers. The machine may be, and probably is, a very good one, but a number of others might be made equally good, and yet be so constructed as not to interfere with it, or with each other.

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30. For improvements in the machinery for *Spinning Hemp;* Chas. W. Brown, Roxbury, Norfolk county, Massachusetts, July 16.

Several different improvements are here described, and claimed in the specification of the patent. The first is in the manner of regulating the winding of the yarn, or twist, on the bobbin. The second is in admitting one of the rollers between which the thread passes, to recede from the others, so as to allow the thread to pass freely, should knots or any foreign matter offer any obstruction. The third is in the arrangement of the draw pullies, immediately in front of the neck of the flier, so as to receive the yarn directly therefrom, without previously passing it over a pulley; there are, also, some minor improvements, which could not be designated without reference to the drawing.

Claim. "First, the employment of a right and left screw, the threads of which cross each other, on the spindle of the bobbin, for giving a rectilinear reciprocating motion to the bobbins, as described. Secondly, the method of giving to the spindle the rectilinear reciprocating motion by means of the fork attached to the shaft of the flier, or to the pulley attached to the shaft of the flier, and by which it receives its rotary motion, as described. Thirdly, the arrangement of the double fork, and spring latch, in combina-

tion with the double threaded screw, for the purpose described. Fourthly, the employment of the cam and spring to retain the fork when shifted by the end of the double screw, in the manner described."

Although, in themselves, the devices referred to are not complex, yet as there are, necessarily, throughout the whole specification and claims, references to the drawings, we are aware that the foregoing cannot give more than an imperfect idea of the nature of the improvements.

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31. For an improvement in *Padlocks, and in Locks of other kinds;* Joseph Nock, city of Philadelphia, (now of Washington,) July 16.

The objects professed to be attained in the construction of these locks, are to secure them from the danger of being opened by a false key, and also of being opened by a blow, given either by accident or design, by which the bolt, or catch, of an ordinary padlock is frequently started, and the lock opened.

There is to be a notch on each side of the bow of a padlock, to which are adapted two catches on what is called an escapement tumbler, and when this tumbler is acted upon by the key, it must be carried to an exact point to allow the bow to be liberated, as otherwise it will be held by one or other of the catches. In other locks the same device may be used, by arranging the parts so as to adapt them to the particular kind to which they are applied. These padlocks are now employed on some of the U. States mail routes, and are to be adopted for the whole as soon as the supply is sufficient.

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32. For a *Planing Machine;* Freeman Walcott, East Cambridge, and James H. Hutchinson, Boston, Massachusetts, July 16.

This planing machine is in its general mode of operation, like that of the late Mr. Woodworth, but the cutters are double ironed, and the claim is to "the combination of the double iron rotary plane with the throat, or mouth piece, constructed and operating as described."

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33. For a *Corn Planting Plough;* Samuel Hoffner, Londonderry, Dauphin county, Pennsylvania, July 17.

There is not any thing special in this corn planting machine, although it differs sufficiently in the arrangement of its parts to entitle it to a patent. The claim is to the "constructing the hopper in two parts, by means of a vertical division passing through the middle of it, in combination with the moving bottom, or slide board worked by a crank attached to the roller; which sliding bottom conveys the corn and gypsum from each division of the hopper, and permits it to fall into the same furrow together. Also, the combination of the fenders for directing the seed into the furrows, as described."

It may be seen from the foregoing, that the division of the hopper is for the purpose of placing the seed corn on one side, and plaster of Paris on the other. The means of regulating the quantity of each to be deposited, do not differ materially from such as have been adopted in other machines for a like purpose.

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34. For an improvement in *Lamps for Burning Spirits;* John S. Tough, city of Baltimore, July 17.

"This improvement consists in raising the horizontal plate at the mouth

of the shade for increasing or diminishing the draft, by means of a metallic frame or screw, instead of raising or lowering the shade or wick," and the claim is to this, and to the particular manner in which it is effected.

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35. For improvements in the mode of making *Hammers and Hatchets*; Phineas Eastman, Concord, Grafton county, New Hampshire, July 17.

The eye of the hammer, or hatchet, is to be oval at one end, and round at the other, the round side being that at which the handle is to enter. This hole, or eye, is to be tapped in the round part, to receive an iron socket, which is to be screwed into it, and to pass through sufficiently far to occupy a portion of the oval part of the eye; an oval punch is then to be driven in at this end so as to open the socket to the eye, and prevent its turning. After this, a wooden handle is to be passed through the socket, and wedged in the ordinary way, to open it to the oval of the end of the eye. The claim is to the "making the socket with a screw on the outside thereof, to screw into the aperture or female screw for the same, and extending it into the oval part of the aperture in the hammer, a short distance, where it is made to assume a corresponding oval shape, by punching, or otherwise, to prevent turning or drawing."

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36. For a *Razor Strap*; Aaron and Luther Hill, Stoneham, Middlesex county, Massachusetts, July 17.

"The object of our invention is to combine a draw for razors with the strap, making one handle answer for both draw and strap, so as to render the shaving apparatus as compact as possible."

"We claim the combination of the razor, draw, spring, and catch thereon, with the strap, as described, so that the handle and draw shall likewise serve as a handle to the strap, and by this arrangement supersede the necessity of a handle extending through the whole length of the strap." We presume that the foregoing contains all the information on this point that will be required to satisfy most of our readers.

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37. For *Weigh Locks for Canal Boats*; Jeremiah Brainard, Rome, Oneida county, New York, July 17.

This weigh lock does not differ materially from those previously in use, and the claim is confined to "the manner of constructing the cradle so as to adapt itself to the pressure of its load by the passing of a chair around pulleys on its sides, constructed and operating as described."

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38. For *Supplying Steam to aid Combustion in Steam Engine Furnaces*; John B. Pettival, Civil Engineer, Charleston, South Carolina, July 17.

"Under the fire, or grate, bars of the furnace to which my improvement is to be applied, I affix or suspend the apparatus which I have devised for the purpose of giving a supply of steam to the fire, this apparatus being applied without its being necessary to make any alteration in the ordinary fire-bars, or in any other part of the furnace. In its form, my apparatus bears a resemblance to the grate of the furnace, being composed of bars which may be so arranged, as, when in place, to be situated immediately under those of the furnace, and thus present no obstruction to the falling of the ashes from the fire. These bars are hollow, having each a perfora-

tion, or channel, for the passage of steam, from end to end; from these channels there are numerous small lateral passages for the escape of steam under the fire bars of the furnace. These perforated bars are connected at each end by cross bars, and their perforations open at each end into a channel, or tube, formed in these cross bars, for the purpose of establishing a free passage of steam through the system."

The claim is to "the making and using of a grate-formed apparatus, consisting of hollow bars, furnished with lateral openings for the emission of steam, said apparatus to be placed below the ordinary fire bars in the ash pit of a furnace, for the purpose described, and its general construction and adaptation being such as is herein set forth."

There is also a claim to "the particular manner of constructing said apparatus, by casting it in two separate portions, which, when placed one upon the other, and properly confined together, will leave the necessary channels for the conveyance and emission of steam."

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39. For a *Grain Rake*; Israel Keyes, Putney, Windham county, Vermont, July 17.

"The object attempted in my invention is to gather the grain easily and quickly into quantities requisite for bundles, and to hold it, when thus gathered, at a convenient height from the ground until it can be bound, thus relieving the labour, by diminishing the necessity for stooping. To effect these purposes, the grain is gathered by six or seven fingers, somewhat resembling the fingers of a cradle, running beneath the grain, and these fingers are propelled by their buts, or rear ends, being fixed in an axletree, supported on two wheels, pushed along and guided by means of two handles." The claims are to "the method of binding grain by means of a rake, in combination with the uprights, or guards, as described. And also, in combination with the above, the stirrup for holding the grain up with the foot, whilst the bundle is bound."

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40. For *Boxes, for Axles and Gudgeons to run in*; Isaac Babbitt, city of Boston, July 17.

There is now an application before the office for additional improvements on this patent, and when this has been decided, and completed, the specifications will be published.

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41. For a *Progressive Pile Driving Machine*; Elijah P. Williams, Utica, Oneida county, New York, July 22.

"The purpose of my invention is to enable me to give to the pile driving machine a progressive motion, by causing it to be sustained by the piles themselves, without the aid of string pieces, or of cross ties, but simply by the aid of shifting wheels revolving on suitable axles, and so constructed that they may be shifted from the head of one pile to that of another, as the work advances, the pile driving machine having on its under side suitable ways or rails fixed along it, at such distance apart as that they may bear upon the above named wheels, and that the machine may be advanced thereon as the work proceeds, a grading saw, or saws, of any suitable kind, is to be employed to cut off the piles as the work proceeds, and thus to prepare them for the reception of the shifting wheels."

"What I claim is the employment of the shifting wheels, made and operating substantially in the manner described, for the purpose of sustaining

and advancing a pile driving machine without the use of cross, or other, ties, the piles being successively driven and cut off to the proper grades, for the purpose of grading."

The shifting wheels run between suitable cheeks, on cast-iron plates, which plates have projecting spikes on their under sides, or passing through them, to affix them in place.

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42. For an *Antifriction Apparatus*; John G. Tibbets, city of New York, July 22.

This is said to be "a new and useful mode of applying rollers around axles, and balls at the ends and shoulders thereof, for reducing friction." The patentee says that he does not claim "the employment of rollers and balls to avoid friction in machinery, but what I do claim is the combination of the two sets of concave flanches with the balls working between them, to prevent the balls from rubbing against the axle and box, in the manner, and for the purpose set forth; and also the reducing the diameter of the rollers at the middle, to form a space for oil."

When we hear, satisfactorily, of the benefits derived from this apparatus, we will give to our readers the matter entire, with all its illustrations; we are very apprehensive, however, that the day is far distant when we shall be called upon to redeem this promise.

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43. For an improved *Bee Hive*; Samuel C. Myers, Mount Pleasant, Westmoreland county, Pennsylvania, July 22.

After a description of considerable length, setting forth, by references to the drawings, the manner of constructing this hive, claims are made to "the arrangement of the drawers, ceilings, and slides, in combination with the rooms, glazed doors, and trunk, as described; and to the additional house for covering the bee house, for keeping the bees warm in winter, and cool in summer; also to the vertical slides at the ends of the bee house, and the trunks leading from one room to the other, all in combination, as described."

Such structures are capable of being made in so many different forms, whilst there is not, really, any substantial improvement effected, that there is often much difficulty in examining them when desired to be patented; and they must, in many cases, be rejected, or passed with a claim to "all in combination, as before described," which gets rid of the difficulty, as respects the examiner, but leaves the patentee without any other reliance than in making his apparatus always alike in all its parts.

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44. For *Obtaining the Rectangle of any Irregular Figure*; Thomas Wood, Smithfield, Jefferson county, Ohio, July 22.

The claim under this patent is to "the application of the principle, that 'solids introduced into fluids, displace a quantity equal to their bulk,' to the mensuration of superficies by means of mercury and glass plates, as described." And the patentee says, "the nature of my invention consists in cutting paper to a corresponding form and dimensions with an accurate plot of the superficies to be measured, and introducing it into a stratum of mercury between glass plates."

The mode pointed out of obtaining the rectangle of an irregular figure, is about as useful and as accurate as some *mechanical* modes which have been proposed for obtaining the quadrature of the circle. It goes upon the

principle, that by ascertaining the quantity of mercury displaced by a rectangular piece of paper, similar to that from which the form of the plot is cut, the quantity displaced by the latter will give the elements of its rectangle, however irregular its outline may be. Who will buy a right?

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45. For *Revolving Caps for Chimneys*; Bernard Kenny, Northfield, Franklin county, Massachusetts, July 22.

"The nature of my invention consists in combining with a revolving cap, a number of apertures surrounding the tunnel, through which openings air is to enter from without by the action of the wind, to assist the draught in carrying off the smoke, said apertures being constructed and operating in the manner of blinds, the slats of which overlap one above the other, leav- a space for the passage of air between them." The claim is to the cap so constructed.

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46. For a machine for *Raking Hay, and Harrowing in Grain*; George Davis, Belmont county, Ohio, July 22.

The claims are to an "additional tooth inserted in the handle (so termed) of each rake, near to, and forward of, the head, forming a double toothed rake; and the combination of the rakes with the tilting frame, as described, by which each rake can rise separately, and the whole of them can be raised by means of the lever."

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47. For a *Copp Speeder;* Truman Estes and Warren Dutcher, Bennington, Bennington county, Vermont, July 26.

We have here twelve pages of record, concluding with a claim to "the combination of the cap sheath and slide cup; also the combination of the transverse rod, spindle, and former, and these in combination with the cap sheath and sliding cup, by which the roving is twisted, wound spirally up and down under the former, and in the cup or cavity of the copp, and then condensed between the former and the sliding cup, as described."

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48. For improvements in *"Nott's Coal Stove:"* Eliphalet Nott, Schenectady, New York, July 26.

The claims under this patent are, 1st, "connecting of the cover and ventilator in stoves in such manner that the two shall open and shut together, as set forth: 2d, the making use of *brick plates* for the walls of chambers of combustion in stoves and furnaces, whether angular or cylindric, constructed as above set forth: 3d, making use of a hollow *brick plate* prism for the lower front of the internal flue, as set forth."

The *brick plates* consist of metallic plates perforated with numerous holes, or covered with spiculae, so as to hold the fire clay, or composition, with which they are to be covered. And with these the stoves are to be lined.

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49. For *Gas Burners:* George Darracott and Joseph Nason, Boston, Massachusetts, July 26.

"The object of our improvements is to render the passages in the burner, through which the gas is conveyed for consumption, more accessible, that the carbonaceous matter which is liable to collect in, and obstruct them, may be expeditiously removed."

The claim is to "the method of supplying the burner with gas through any number of straight perpendicular tubes, or apertures, opening into a

circular space above, and into a common feeder or reservoir below, which feeder may be taken off at pleasure for the removal of any obstruction which may occur in the said tubes or apertures."

The cylindrical body of the burner has a screw cut on its lower end, by which it is screwed into a bottom, or seat, which bottom screws on to the gas tube. Holes are drilled, in a vertical direction, between the openings in the cylindrical body of the burner, through which air is admitted to the interior flame; which holes lead into the annular space below the perforated steel plate for the jets. When this cylindrical body is unscrewed from its seat, any obstructing matter may be readily removed through the said straight holes. The circular space below the jet plate is cut from the solid metal, and the holes are drilled into it from below.

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50. For *Constructing Rail Roads*; James Stimpson, Baltimore, Maryland, July 26.

"The nature of my invention consists, for the superstructure of railroads, in first placing heavy square or other shaped timber string pieces, or logs, hewed, or slabbed by saws, on two sides at least; that is, the sap should be removed from the top and bottom as laid in the earth, and these string pieces are to serve as the foundation of the road, and are to be laid in two continuous and parallel rows, about eighteen inches below the surface of the earth, for the support of cast iron chairs. The chairs are to be fastened on the top of the string pieces, and the longitudinal iron track rails are to be secured in the openings in the tops of the chairs. These chairs are formed with two upright standards resting on the middle, laterally, of each string piece, about the width of the track apart, and eighteen inches high, and connected by two trusses, ranging from one to the other."

Instructions are given for laying the string pieces where there are embankments, and also where there are excavations, or deep cuts. In all cases the wood upon which the chairs are fastened, is to be sunk deep in the ground, where it is estimated that the timbers will not decay in less than from fifty to a hundred years.

The claim is to "the combination of the wooden foundation string pieces immersed in the earth, with the iron chairs and track rails, in contact with zinc, or without zinc, as set forth."

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51. For a *Brick Machine*; Daniel Carpenter, Courtland, West Chester county, New York, July 26.

We shall not attempt to describe this machine, which is intended for moulding and pressing bricks, it being too complex for verbal elucidation. The claims refer to the drawings, and it would be useless, therefore, to insert them here.

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52. For a *Drill Barrow for Sowing Seeds*; Martin and Samuel L. Seward, Guilford, New Haven county, Connecticut, July 27.

There is not any general difference between this seed sowing machine and others of older date, and the claims made are to the particular manner of arranging the parts, as adopted by the patentees.

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53. For a *Churn*; John S. Thomson, Wyalusing, Luzerne county, Pennsylvania, July 27.

This is a vertical churn, within which there is a vertical shaft, carrying

dashers. By means of suitable gearing, and a strap passing round the shaft above the body of the churn, said shaft is made to turn back and forth one half of a revolution. The dashers are composed of flat slats, set obliquely, like those of a window blind, and the claim is to the "placing the vertical paddles [slats] obliquely on the horizontal parallel arms, so that they shall force the cream, when moving in one direction, from the centre to the circumference of the churn, and when turned in the opposite direction, throw it back towards the centre, as described."

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54. For an improvement in the *Grist Mill*; Henry Pearce, Cincinnati, Ohio, July 29.

This is said to be an improvement on the mill patented by J. C. Smith, on the 9th of January, 1830. The patentee says, "My improvement consists in the manner in which I construct the part which I denominate the pressure rod, which is intended to elevate the bridge tree, and consequently the running stone, and to regulate the action of the mill in this particular part." The pressure rod is constructed with a flanch around it, which, when the runner tends to rise, bears against a part of the frame within which the lower stone is inclosed, and counteracts this tendency.

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55. For *Clearing Railroad Tracks from Ice, &c.*; John N. Dennison, and Elias Kirkpatrick, Plainfield, Essex county, New Jersey, July 29.

The plan for clearing off ice and snow from rails, consists in affixing scrapers and revolving brushes on the fore end of a locomotive. The scrapers are to be placed obliquely, so as to throw the ice, or snow, outwards, and they are fixed in spring bearings, so as to admit of their yielding when necessary. The brushes are made to revolve just back of the scrapers, and are intended to remove the snow, or ice, left by the scrapers. The claim is to this arrangement, which, we apprehend, will, in most cases, be so inefficient as to cause it soon to go out of, if it ever has been in, use.

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56. For an improvement in *Locks and Latches*; Nathan and Caleb Hunt, Cleveland, Cayahoga county, Ohio, July 29.

This patent is taken for an improvement in the method of applying the lever and spiral spring to locks and latches for doors.

There is in this lock a slide, or lock bolt, and a latch which lifts by turning a knob, and these are combined together in a manner which prevents the latch from being lifted, when the door is locked. We do not think it worth while to give a long description of this contrivance, or of some other things connected therewith, as there is not any special merit in the affair, to render this lock better than others now in use.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent granted to HOMER HOLLAND, *of Westfield, Massachusetts, for manufacturing White Lead, &c. Dated March* 18, 1836.

To all to whom these presents shall come, be it known that I, Homer Holland, of the town of Westfield, county of Hampden, and state of Massachusetts, have invented a new and useful improvement in the process for oxidizing metallic lead, and for making and producing carbonate of lead, or

pigment commonly known by the name of white lead, which improvement has not heretofore been known or used, and that the following is a full and exact description of said improvement, sufficient to distinguish the same from all things before known, and to enable any person skilled in the art or science of making or producing the salts, acetate and nitrate of lead, from any oxide, or the carbonate of lead, to apply and use said improvement in the making and compounding of the same.

The invention consists, 1st, In an improvement in the method of applying the conjoint action of friction, air, and water to metallic lead, by placing fragments of this metal in revolving leaden cylinders, or chambers, so as to produce a fine powder, or pulpy suboxide of lead, for making, or producing, the commercial salts, nitrate and acetate of lead.

2d, In combining carbonic acid, from the atmosphere, directly with this suboxide, as it is formed in the cylinder, by the addition of carbonate of soda, or other alkaline carbonate, so as to produce or make the carbonate of lead, or the pigment known as white lead. To effect the oxidation of the lead, I put coarse shot, or other fragments of unalloyed lead, into a leaden cylinder, or chamber, about four feet in length and three feet in diameter, made to revolve, horizontally, upon an axis of flanches. The leaden cylinder, or chamber, is inclosed in a strong and tight wooden case; air is admitted by perforations of the cylinder at its ends, near the axis; soft water is put into the chamber, sufficient to cover the charge of shot, or fragments. The cylinder is made to revolve eighteen or twenty times in a minute, by the application of any force, and the electro-chemical action of the friction, air, and water, produces a fine pulpy suboxide of lead, which is strained out by removing a bung from the side of the cylinder, and placing therein a hollow tube, leading to a sieve, or strainer, resting on a canal, or trough, which conducts to a reservoir.

This pulpy suboxide, sufficiently freed from water, is readily combined with acetic acid, giving "sugar of lead," and with nitric acid producing nitrate of lead. To make carbonate of lead, the process is identical with the above described for the suboxide, with the addition of about six or eight ounces of the carbonate of soda to each gallon of water used in the cylinder. The cylinder is revolved several hours in producing the suboxide for the salts of lead, and from twelve to sixteen previous to straining out the carbonate, or white lead, which is conducted, as above described, to a vessel armed with agitators, and washed, by decantation with pure water, once or twice, to free it from alkali, when it is to be dried by any convenient means, becoming the pure carbonate, or "cream" white lead of commerce. In this process for white lead, the use of vinegar, and of acetic, or acetous, acid, in any shape, is avoided, and the health of the manufacturers is preserved from the fumes of the volatile peracetate of lead, so deadly in the ordinary process. The foregoing process I prefer; but the revolving chambers may be cylindrical, square, or polygonal, of any size and length. The lead linings of a wooden cylinder may be of sheet lead, or cast in a cylinder to fit the wooden case, or carcass, and are to be renewed from time to time as they frit away. The number of cylinders, their weight, and the charge, will depend on the force employed, and the extent of the manufacture. Each cylinder, (principally the lead chambers) may weigh 600 lbs.

The charge added is from 100 to 150 lbs. in fragments, and the necessary water and carbonate of soda. The lead fragments may be shreds of sheet lead, shot, or fragments produced by pouring melted lead through a colander into water. Antimony, and other alloys of metals, are often mingled

with lead in the shot of commerce, and unfit them for this process. The alkali preferred is soda, as this has the strongest affinity, or attraction, for oxygen and carbonic acid, and is less liable to form a hydrate. The pulpy suboxide may also be conveniently carbonated in the vessel employed for decantation, (as it is armed with agitators) by passing it into the pulpy suboxide, as withdrawn from the cylinders. Carbonic acid, produced by the combustion of charcoal, by fermentation, or by the decomposition of carbonate of lime, or chalk, by sulphuric or hydrochloric acid. The decanting vessel, again, may be used conveniently in removing the disagreeable yellowness of pure carbonated lead, by minutely mingling a trifle of indigo, or blue smalts, with the carbonate of lead.

I claim, as my invention and improvement—

1st. The application of the revolving cylinders, or chambers, as above described, to the fritting, comminution, amalgamation, or converting of metallic lead into the fine pulpy suboxide of lead, for the salts, acetate and nitrate of lead—or carbonate of lead.

2d. The carbonating of the above described suboxide, as it is formed in the cylinder, by the addition of an alkaline carbonate, or by passing into this pulp directly, carbonic acid, giving immediately white lead.

HOMER HOLLAND.

Specification of a patent for Manufacturing Carbonate and other Salts of Lead. Granted to HOMER HOLLAND, *Westfield, Massachusetts, November 3d,* 1838.

To all to whom these presents shall come: Be it known, that I, Homer Holland, of the town of Westfield, in the county of Hampden, and state of Massachusetts, have invented several new improvements in processes for compounding, making, and producing pulpy compounds from metallic lead, and of converting said pulpy lead into sulphate and carbonate of lead for white pigments; and also for making of said pulpy lead into chromate of lead, known as chromic yellow; which special improvements in compounding have not heretofore been known or used: and that the following is a full, discriminating, and exact description of said methods, sufficient in detail to distinguish the same from all other processes, and to enable any one skilled in chemistry to apply and use said improvements understandingly. The special improvements which I would describe and claim, consist, 1st. In using any alkaline salt, or substitute, in the moistening solution for the charge and chamber, or open headed cylinders, described and mentioned in my patent dated the 18th day of March, 1836, whose elements consist essentially of oxygen, carbon, and hydrogen, in any proportions, instead of alkaline carbonates, before recommended and employed, as they augment the electro-chemical action, increase the product, and modify and facilitate the combination of the elements with nascent pulpy lead, by their presence, or catalytically.

Acetates of lead, whether neutral or basic, also sugar, and even alcohol, may be advantageously used in the solution, to moisten charge, chamber, and pulp.

2d. In adjusting the pulpy plumbic compound, produced as described in my said patent, for acetate and nitrate of lead, or with the catalytic additions with neutral chromate of potash, or soda, or by dissolving the alkaline

chromates in water, and using this chromic solution as the moistening of charge and chamber.

The chromic pulp, after subsiding, may have most of all the alkali withdrawn by decantation, and the remainder neutralized by washing with water, made acid by sulphuric or other acid.

The commercial bichromates of potash and soda are to be made neutral by the addition of suitable proportions of their respective bases.

The economy of the above process, in making chromates of lead, is in substituting the plumbic compounds in their nascent state for the expensive plumbic salts, acetate and nitrate, now usually employed in the manufacture of chromic yellow.

3d. In my said patent for oxidizing and producing lead pulp, although, in the incipient stage of the operation, the lead may be an under oxide, the subsequent exposure, in the open-headed chambers, to the continuous and conjoint action of the elements which constitute the atmosphere, water, and catalytic additions, together with the friction, and the known and established property, or capacity, which all metals, in a minute state of division, have of absorbing, "dissolving," or combining with, all elements with which they are in contact, constrains me to disclaim the opinion, that plumbic pulp, under any circumstances, can be considered a definite compound, and much less an oxide; but that it is a compound of lead, into which the elements, hydrogen, carbon, and nitrogen, and their compounds, enter, as well as oxygen.

By the foregoing explication of the pulpy plumbic compound, the following rationale of the modifications of the pulp, in converting it into a perfect carbonate, or sulphate, will be apparent. After carbonating the pulp with certain catalytic additions, artificially, should there be any basic salt, it is to be removed by washing in an alkaline solution, boiling, particularly in making the sulphate of lead, the pulp must be boiled to modify the plumbic hydrate by more highly oxydizing the pulp.

The sulphate of lead is made directly from the pulpy lead, modified and oxydized by heat, while in its moistened state, by digesting it, in any quantity, with sulphuric acid of commerce, previously diluted with twice its measure of water, (more or less) and suffering the acid thus diluted to become perfectly cold previous to adding the pulpy lead.

It is necessary to boil the dilute sulphuric acid and pulp thoroughly together in a shallow leaden vessel, with rather an excess of acid, that the product may become a perfect sulphate; in this, great caution is requisite, otherwise the product will be, more or less, a mixture of sulphate, hyposulphate, or sulphanide, of lead, and its colour changed by mixing and painting in oil. Besides, it will not be as dense, fine, and fusible.

All the pigments should be thoroughly washed in several waters, and may be dried by the well known methods.

The cylinders mentioned in said patent, I now make about four feet in length, and thirty inches in diameter, wholly of lead, either sheet or cast, about one-fifth of an inch in thickness. The ends are entirely open, except an inner rim to retain charge and moistening fluids, or solution, with forming pulp, and allow a free circulation of the atmosphere for its elements.

They are mounted on an axis, passing through their centres, and the centres are of iron, with arms which are attached to the rims of each end of the cylinders. The rotations may vary from six to nine times in a minute, and are moved by a drum and belt, or other gearing. The pulpy lead may be withdrawn every six, eight, or twelve hours. The medium charge is

fifty pounds, and the moistening fluid, or solution, from three pints to three quarts, or more.

I claim, 1st. The process and method of using the alkaline salts, carbonates, and other catalytic substitutes, as hereinbefore mentioned, in moistening charge, and chambers, described and mentioned in said patent, in producing pulpy plumbic compounds; and I do not intend to restrict their application and use to pulpy leads produced by revolving chambers alone, but to extend their application to the compounds of lead produced by other methods of friction, whether substituted, or adopted, to evade my chambers.

2d. I claim making chromate of lead, as above specified and described.

3d. I claim modifying the pulpy plumbic compounds above described for carbonate of lead, and particularly the processes described for making a definite sulphate of lead, by digesting, boiling, and washing, as above discriminated, and made plain and distinct. HOMER HOLLAND.

Specification of a patent for an Improvement in Manufacturing White Lead. Granted to SMITH GARDNER, *city of New York, August* 28, 1840.

To all whom it may concern: Be it known, that I, Smith Gardner, of the city of New York, in the state of New York, have invented an improvement in the process of manufacturing white lead, known to the chemist under the name of carbonate of lead; and I do hereby declare that the following is a full and exact description thereof.

The first part of my procedure consists in the treating of metallic lead by the well known process by which a pulpy substance is produced, which is known to manufacturers under the name of suboxide of lead. This process consists in the placing of granulated lead, or lead in fragments, in vessels lined with sheet lead, and containing water. These vessels may be in a cylindrical form, and made to revolve on their axes, like barrel churns, or they may have a reciprocating instead of a revolving motion; and they may be, and have been, varied in form in different ways, the only essential point in their construction being that the lead contained within them may be subjected to continued attrition. Thus far, the process is identical with that which has been adopted and followed in many manufactories, in which it has been attempted to manufacture white lead from the suboxide of lead so produced.

In these attempts it has been proposed to carbonate the suboxide of lead, by putting portions of carbonate of potash, carbonate of soda, or other carbonates, into the water with the lead undergoing attrition, it having been supposed that the alkaline carbonate would give up its carbonic acid to the oxide of lead, as said oxide was formed. Independently of the known affinities of the respective articles named, I have proved, by repeated experiments, on a large scale, that carbonate of lead cannot be produced in that way. Another attempt to convert the suboxide of lead, obtained by trituration, into white lead, has been by taking the said pulpy oxide, agitating it in a vessel containing water, and forcing a stream of carbonic acid, or of carbonic acid mixed with atmospheric air, through it. By this process a carbonate of lead has been produced, but in so imperfect a manner, as to leave it destitute of all the essential properties of that article; wanting the density, body, and freedom from colour, found in good white lead. In consequence of these defects, the attempts hitherto made to manufacture white lead from the suboxide produced by triturating fragments of lead in leaden vessels, under water, have proved abortive; but, by a very simple variation of the

process, I have succeeded in producing good white lead, which has been pronounced by judges to be equal to the best that is imported.

As it was fairly proved that the suboxide would not combine with the carbonic acid, after said suboxide had been fully formed, I determined to vary the process so as to present the carbonic acid, in conjunction with a portion of atmospheric air, to the suboxide of lead in its nascent state; and this I have found perfectly effectual. In order to effect it, I triturate my lead with water in leaden cylinders, or other vessels, as above described, but, instead of leaving the vessels open, or perforating them, for the admission of atmospheric air, I make them close, by means of suitable shutters, or stoppers, which may be removed whenever it is necessary so to do; and during the whole time that the trituration is continued, I introduce carbonic acid, accompanied by atmospheric air, into the triturating vessels. When these vessels are in the form of horizontal cylinders, I pass the gases into them through hollow gudgeons; a mode of construction and procedure well known to machinists; under other forms or modes of constructing my triturating vessels, I adopt whatever means I may consider the best for introducing the gases within them. The result of this process is, that the nascent suboxide of lead presented to the oxygen of the atmospheric air, and to the carbonic acid, combines with them, and at once produces a perfect carbonate of lead, possessing all the essential properties of that article. I in general open each triturating vessel once in about twelve hours, to remove the carbonate of lead which has been formed within it. This may be done more or less frequently, according to circumstances.

When the carbonate of lead thus manufactured, is first obtained, it generally has a light tinge of blue, but this disappears in the process of drying, and it is not important, therefore, to adopt means to prevent it; I have found, however, that by introducing a very small portion of the vapour of vinegar in conjunction with the atmospheric air and carbonic acid, the white lead is at once obtained perfectly free from colour.

The carbonic acid may be generated by the combustion of coal, or by the decomposition of carbonate of lime, or of other carbonates.

Having thus fully shown the manner in which I conduct the process of manufacturing white lead, or carbonate of lead, and pointed out the difference in the process as adopted by me from those heretofore followed, what I claim therein as of my invention, and desire to secure by letters patent, is, simply, the introduction of carbonic acid and of atmospheric air into closed *vessels* in which fragments of granulated lead is subjected to long continued attrition in water; the introduction of these gases being intended to supply the portion of oxygen and of carbonic acid necessary to convert the nascent suboxide of lead into white lead; by which means a perfect combination is effected, and the desired result attained, as herein set forth.

Smith Gardner.

Remarks by the Editor.—We have inserted the three foregoing specifications on the manufacturing of white lead, and of other compounds of lead, because the particular process upon which they are dependent, that of producing these compounds from lead comminuted by trituration, has, of late, excited much interest, and been a subject of frequent inquiry. The first of these specifications leads to the conclusion, that Mr. Holland supposed this process to be new in the year 1836, whilst the fact is that it was the subject of a patent obtained by Joseph Richards, of Philadelphia, in the year 1818. A manufactory was also established at Norristown, Pennsylvania,

in which the triturating process was employed, and after essaying the thing for a considerable length of time, the plan was given up. The white lead produced was deficient in body, and its colour was said not to be good.

That Mr. Holland found the process of 1836 defective, is to be inferred from his patent of 1838, for improvements in it. We should be glad, however, to obtain his own account of this matter, as we might err greatly by detailing the information received from others.

Mr. Holland's second specification we think much more elaborate than clear; had language more simple been used, it would have rendered his meaning more obvious to the great body, even of those "skilled in the art." We have ventured to insert, and to change a few words, where we thought that it might be safely done, but further than this we have not gone.

On the 7th of June, 1838, Mr. William Cumberland, of New York, obtained a patent for a process of manufacturing a white pigment, the specification of which we published in vol. xxiii., p. 402. The patent obtained by Mr. Gardner is, it will be seen, for a particular variation of the process of oxidizing and carbonating the pulpy lead, and by which, he states, a very superior white lead is obtained; and his statement has been corroborated by others. We shall have something further to say on this subject.

Progress of Practical and Theoretical Mechanics and Chemistry.

M. D. Richemont's Autogenous Soldering, or new mode of joining plates or tubes of lead and other metals without soldering.

"Autogenous soldering" is the term given by its inventor to a new method of joining one piece of metal to another without the use of any solder. The autogenous *junction* of metals is a phrase by which the invention might, perhaps, with more propriety be designated. But be this as it may, the invention is one of vast importance both to our chemical and engineering manufactories, and will speedily work out a name for itself, and for its inventor a distinguished reputation. The process consists in uniting the parts to be joined, by fusion of the metal at the points or lines of junction; so that the pieces, when joined, form one homogeneous mass, no part of which can be distinguished from the rest even by chemical analysis. And this result is obtained by means of intense jets of flame, produced by the combustion of air and hydrogen gas, and are rendered quite as manageable as more substantial tools.

The inventor, Mons. E. Desbassays de Richemont, obtained at the last National Exhibition of Arts at Paris, a gold medal for his invention. The committee on whose recommendation the medal was awarded, included those distinguished chemists, Gay Lussac, Thenard, D'Arcet and Clement Desormes; and their report concluded in the terms:—"We consider M. Richemont's invention of the highest importance; it is applicable to many branches of industry, and will render signal service to a great number of manufactures. Its efficiency too has not only been established by experiment, but is evidenced by the fact of most of our eminent manufacturers and tradesmen having taken out licenses for the use of it."

Patents have been also obtained for the process in Great Britain and Ireland,* of which Mr. Charles Delbrück is the proprietor.

* The English patent was taken out in the name of Mr. Hebert, for "Autogenous Soldering of Lead."

The invention has been put in operation by Mr. Delbrück, on the premises of Messrs. Andrew Clarke and Sons, Plumbers, in Southwark, where we have had the pleasure of witnessing the complete efficiency of the process, as applied to the manufacture of vessels, tanks and other articles of lead, and also sufficient to convince us of its applicability to the soldering of the harder metals.

[The apparatus consists of a hydrogen gas blowpipe attached to a vessel in which the gas is constantly generated while the soldering is in operation. A square leaden tank or vessel is divided horizontally into three compartments. The upper one contains dilute sulphuric acid, and the lower one zinc cuttings, and by a tube which passes from the one to the other, governed by a plug, the acid is let down upon the zinc at pleasure. The gas passes into a vessel containing water, placed in the middle compartment, and thence through a tube to the blowpipe. This tube has a branch connected with a double bellows which may be worked by the foot of the operator. Thus a stream of ignited hydrogen, fed at will by one of atmospheric air, is made to play with great ease upon the surface to be soldered. A figure of the apparatus is given in the London Mechanics' Magazine, No. 872.]

From the description given of the new mode of joining metals, it will be seen that the junction is necessarily secure from the chances of flaw which in the old method were occasioned by—1, the difference of expansion between the lead and its alloys with tin, a difference which is particularly felt in very low or very elevated temperatures; 2, the electro-chemical actions which are developed under certain circumstances by the contact of two heterogeneous metallic substances;* 3, the very powerful reaction which a number of chemical agents exercise upon alloys of lead and tin though not upon lead alone; 4, the extreme fragility of these alloys, which, particularly when heated, break sometimes on the slightest blow; 5, the difficulty of making the solder take and adhere to the surface of the lead where it sometimes only sticks without the workman knowing it; and, 6, the use of rosin which so frequently conceals fractures for a time.

As the method of M. de Richemont is, however, employed by persons upon whose care it is impossible always to depend, it cannot be pretended that the autogenous soldering never presents any defects; but then they result *only* from negligence, the nature of the work being such that however little attention the workmen may give to it, they ought immediately to perceive the smallest imperfections: good workmen may therefore always guarantee beforehand the goodness of their work, which the uncertainty of the old method would rarely allow.

We may therefore justly state, without being taxed with exaggeration, that the adoption of the new method of soldering will very much diminish the number of cases of the escape of water and gas, which occasion every day so much inconvenience, and even danger, as regards the stability of buildings, the maintenance of the public thoroughfares, and the security of life.

The disuse of charcoal and tin, by plumbers, will be an important means of rendering their trade less unhealthy—the exhalation of their brasiers and

* M. M. Vauquelin and D'Arcet have seen in soap works the soldering of vats lined with lead, crumble in a few days to a state of powder. The same has been remarked of leaden pipes passing through certain soils.

the arsenical vapours emanating from impure tin, being frequently the cause of serious maladies.

Finally, we may be permitted to add, that if the new method of soldering had been in use, we should not have had to deplore the destruction by fire of the corn-market of Paris, of the cathedral of Chartres, or that of Bruges, which was occasioned by the negligence of plumbers; negligence for which if the present invention were used there could be no reason, since it is only requisite to turn a cock in order to extinguish or relight, at any moment, the jet of gas which serves for the plumber's tool.

To these various considerations drawn from the public interest, and which alone ought to secure a preference to autogenous soldering on the part of the Government, the public, and men of science; we will add a few others, which though of a minor importance, are not unworthy of notice.

Such for instance are the advantages presented by this method in an economical point of view.

The total disuse of the alloy of lead and tin now employed will enable the master plumbers to reduce the prices of their work very considerably in many cases, and will prevent as well in regard to themselves as to individuals who find their own materials, those abuses so publicly notorious, which the use of so expensive a material gives rise to, and which at the same time, so easily escape detection.

The disuse of seams or overlappings, which from this new mode of connecting lengths of lead, will almost entirely be given up, will alone occasion a considerable saving in the quantity of lead employed.

The extreme facility with which lead of from one-thirtieth to one-tenth of an inch in thickness may be soldered and defects repaired, will permit of the substitution of this, in many cases, for thicker lead, and thus diminish the expense; perhaps also it will give rise to the use of lead for purposes to which it has not yet been applied, or the return to others, in which, from motives of economy, it has been supplanted by other metals.

In a purely technical point of view, the art of the plumber will be indebted to M. de Richemont's method for several improvements of high importance. Thus he will be enabled henceforward to make joints internally wherever a jet of flame can be introduced and directed; to reconstruct on the spot, of pure lead, any portion of a vase, a pipe, or a statue, that may have been removed or destroyed; to execute one after another any number of successive solderings; to repair in a few minutes without even leaving a trace, dents, cracks, flaws, &c., in sheets or pipes of new lead, or the defects of the autogenous solderings themselves; to do away entirely if desired, with the enormous edges or knots left by the old-fashioned joints, and that without weakening them; in short, to give to works of lead a precision of execution, and a solidity, unattainable up to this time, so that this metal shall be available at once in all the combinations required by the civil and hydraulic engineer, however complicated they may be, and in all the ornamental forms that the architect may desire to give it.

But there is a class of artisans to whom the processes of autogenous soldering are more important than to all the rest, namely, those who follow the various and numerous branches of the chemical arts. The possibility of making of pure lead, vessels and instruments of every form and all dimensions, is for them, we may boldly assert, an important attainment; for in chemistry particularly, the execution of the happiest conceptions has been frequently arrested by the imperfection of the means. We therefore think

it necessary to enter into some particular details on the application of autogenous soldering to the necessities of these arts.

We will not dwell on the difficulties experienced, even in experimental laboratories, in procuring retorts, recipients, jars, basins, &c. of pure lead, which can only be accomplished with difficulty and by a long and expensive process; but to give an idea of the importance that practical chemists attach to the having at their disposal large vessels of lead without alloy, we will remind our readers that the *Sociétié d'Encouragement*, who so justly appreciate the progress of national industry, awarded, in the year 1835, a gold medal to Mons. Voison for having succeeded in casting a sheet of lead sufficiently large to make, by raising and turning in the angles, boilers of one piece and without soldering, applicable to the various purposes of the chemical arts.

In future there will be no limit to the size of sheets of lead in a single piece, whether cast or in layers, since it now only depends upon the number of sheets that it is desired to unite in one. Thus the boilers necessary for the process of acidification and the concentration of saline solutions may be constructed of pure lead whatever be their dimensions. The same applies to scouring vats (*bacs à dérocher*,) employed by so many artisans who work metals, to crystalizing tubs, and, in general, to vessels of every kind used to contain liquids which act upon the tin solder.

Independent of the advantages which the autogenous soldering offers in the construction of new utensils, in regard to dimensions and form, the facility that it gives for repairing them is, perhaps, in an economical point of view, still more important, particularly for such as are exposed to the action of heat. By the old method, the holes which are so frequently caused in the bottoms of these vessels, either by the action of sudden flames, or by deposits that form on their surface, can be stopped only when they are not of too large dimensions, by making what are called weldings of pure lead. The cases in which this mode of repair is possible are very limited, and whenever it is impracticable, the boilers must be taken down, the lead changed, and then reset; operations, the expense of which, at all times considerable, is augmented by the distance from the place whence the metal is procured, from the cost of transport, and the longer interruption to business. Now nothing is easier than to apply pieces, whether at the bottom or the sides of the vessels, whatever be the size of the holes; and by this means one may actually renew, piece-meal, the whole of a boiler. There will therefore never arise a necessity for changing them, except when entirely worn throughout, and then there will be this advantage, that the old pieces, instead of being a mixture of lead and solder, will be free from every kind of alloy, and consequently, will yield at the melting pot a metal perfectly pure.

The very great ductility of lead, which in many cases is one of its most valuable qualities, is, on the other hand, a great inconvenience whenever we require utensils or instruments capable of offering a certain resistance. At the same time, there are circumstances where this metal alone can be employed, on account of the manner in which it resists chemical action. By constructing vessels or instruments of iron, zinc, or wood, and lining them, either externally or internally, or on both sides at once, with thin lead, which can always be done, however complicated their forms, we shall in future have utensils that will resist pressure and blows, and likewise all the chemical agents, as well as if they were entirely made of pure lead. Without entering into a detail of the operations to which this plan may be most suc-

cessfully applied, we will mention, by way of example, the production of hydrogen under a heavy pressure, the preparation of soda water and other gaseous waters, the distillation or evaporation of acid or alkaline fluids, under a lower pressure than that of the atmosphere, &c.

It is almost superfluous to add, that the various utensils, such as funnels, pumps, syphons, shovels, spatulas, spoons, ladles, measures, stoppers, skimmers, &c., employed in chemical factories, may always, by this means, be made of wood, or metal, covered with lead.

Another application that deserves some notice, is that of lining common barrels with lead one-sixteenth to one-eighteenth of an inch in thickness. These vessels would be of great utility in chemical factories, more particularly in the construction of the apparatus of Woulf and other pneumatic instruments,* to which greater dimensions could be given by this means; but they could be employed with singular advantage in the transport of acid and alkaline liquids by sea and land. We know, indeed, that all liquid chemical products, and especially the sulphuric and hydrochloric acids, are transported in stone bottles placed in baskets, which, when sent a great distance, must, on account of their fragility, be covered with a double package. This precaution is, however, far from being sufficient always to prevent those accidents which the breakage of these bottles would occasion, both in the loss of the acid, and its action on surrounding bodies. Thus the exportation by sea, of the sulphuric and hydrochloric acids, is limited to a small number of parcels, and is absolutely *nul* in regard to those countries that can be reached only by long voyages—the case of the two French ships that perished at sea on a voyage to the colonies, in consequence of the breaking of some bottles of sulphuric acid, having with good reason alarmed the owners and assurance companies.

By putting these acids into barrels lined as we have stated, and closed by means of plugs of lead soldered, we may effectually escape all accidents of this kind; and the conveyance of these acids will be attended with no more danger than that of any other liquid. These lined barrels offer, besides, a considerable advantage over the bottles in single or double cases, in regard to the tare and the bulk, an advantage which must naturally be the greater, from the barrels having a larger capacity, and the quantity conveyed being larger, the selling price will be lower. This will be particularly obvious in the case of hydrochloric acid, the price of which is so low that it will not admit of carriage to places at any distance.

Barrels lined with lead are particularly adapted to keeping acids and other chemical products in store, and we may presume they will, on this account, come into general use among persons who retail, or habitually consume, these articles; such as chemists, apothecaries, druggists, grocers, &c. By means of cocks conveniently disposed, and syphons or hand engines of pure lead, similar to those of publicans, these liquids can be drawn and served with the greatest facility, while these operations are always dangerous to persons not well accustomed to them, when stone bottles are employed.

* Nothing can be more convenient than the new method of soldering for filling up Woult's apparatus, and all others in lead, from the facility that it gives for soldering, unsoldering, and resoldering, as many times as may be desired, the pipes, tubes, lids, &c. There is no practical chemist who will not be instantly struck with this advantage; and it is probable that hereafter soldering may supplant, in numberless cases, the lutes that are now employed, and which so frequently occasion miscalculations and loss of time and money.

Hitherto it has been impossible to introduce into chemical factories, the system of evaporation by means of pipes heated by steam, because of the action of the acid or alkaline fluids on the worms of copper or lead soldered with tin, which it was necessary to make use of. At the same time, the advantage of this system, which has been adopted for several years in different arts, would be still greater if it were applied to fluids that are evaporated in leaden boilers, such as solutions of alum, copperas, ammoniacal salts, &c.; for, as these boilers cannot be in immediate contact with the flame, but are always of necessity separated from it by an inch either of metal or of masonry, the fuel is far less economically employed in this mode of heating than in any other, and yet every body knows that in the preparation of the majority of the salts, the expense of fuel is one of the most important elements of the price of the product. The ease with which boilers, or other utensils heated by steam, may be arranged at any height, and in any position—with which any form may be given to them without reference to the situation of furnaces—with which the application may be suddenly suspended, checked, and renewed at will, and at any period of an operation, by simply turning a cock, will be invaluable in the chemical arts, under many circumstances already known, and a number of others that may be foreseen—the progress that science is daily making tending to show that the reactions vary exceedingly with different temperatures.

By the aid of the new method of soldering, all these advantages will be easily realized, since we can now make worms of pure lead in any shape, of any dimensions, and of any thickness; and if it were necessary to exceed the limits of ordinary pressure for fluids of great density, such as sulphuric acid for instance, we could no doubt employ a pipe of iron or copper lined with lead, the resistance of which would then be indefinite. With regard to the coppers themselves, there would be nothing to prevent the use of those of one-eighth of an inch, instead of from two-eighths to four-eighths of an inch, which it has been necessary to use hitherto; and yet we shall be secured from the effects of the fire, which, by causing holes, frequently occasion an enormous loss in material, to say nothing of the various expenses enumerated above.

We will conclude with a few observations on the very particular importance of M. de Richemont's method in sulphuric acid factories.

It is well known that the establishments in which this acid is manufactured are composed of a series of chambers or utensils of lead, which present, generally, a capacity of 25 to 50,000 cubic feet, and sometimes from 200 to 250,000. There is not one of these factories, the construction of which does not employ many thousand pounds weight of tin solder. The constant contact of the lead and the solder with the sulphuric acid, and particularly with the nitrous vapours, subjects the solder to an action so powerful, that in a short time there are so many fissures, produced by its destruction, as to render useless, if not the entire apparatus, at least some of the chambers which compose it. Thus the manufacturers are burthened every year with repairs and partial reconstructions, which are the more expensive because they bring with them all the cost of demolition, changing the lead, stopping of the works, and resetting the apparatus. No doubt the action of the nitric acid on the lead itself plays an important part in the destruction, more or less rapid, of the chambers; but on the other hand, we are correct in stating that they are injured particularly at the parts soldered, and more especially at the angles, where the acids are in direct contact with masses of solder. We are therefore justified in hoping that chambers constructed en-

tirely of pure lead would prove more durable than those soldered by the existing method.

A circumstance that adds to this probability is the facility with which we shall be enabled in future to repair the slightest damage at the moment it occurs, even while the chambers are at work, provided the part affected be in sight, and thus prevent the increase of holes, or cracks, which, when neglected, it frequently becomes impossible to repair without stopping the works, which always occasions a heavy expense. The constant examination and preservation of the lead work will be the more easy under the new system, since it permits the adoption of a mode of finishing and setting, by means of which almost the whole of the angular joints, and generally the vertical ones, are made on the outside of the chambers. The *Chalumeau aerhydrique* being besides always in readiness, and as its flames can be conducted without even deranging the instrument, to a distance of several fathoms from the place where it stands, people will no longer be disposed, as before, always to delay repairs apparently insignificant, for the sole reason that it was necessary to light a brazier, to heat irons, to melt masses of solder, and sometimes to disturb several workmen, to carry the whole into the centre of some complicated carpentry,—difficulties that are of great weight in practice.

What we have before stated respecting the advantages arising from the disuse of seams, will apply particularly to chambers for sulphuric acid, in which this mode of soldering is employed. But this advantage, although very great, is here but little in comparison with that resulting from saving the whole of the solder; and if we add that in most localities the use of gas offers a considerable reduction in the expense of fuel, and that there is also a great diminution in the work of the men, it will be seen that if the manufacturers of chemical products really know their own interests, there will not henceforward be a single sulphuric acid chamber constructed or repaired on the old system. In fact, the manufacturers of Paris were so sensible of this, that even before Monsieur de Richemont's method had attained any kind of publicity, they came to him to treat for its introduction into their establishments, and since that time the system has been adopted in the greater number of the sulphuric acid factories of the north of France. Among others, M. Gay Lussac (the Faraday of France) has taken a license for the establishment of St. Goblins, which is under his immediate superintendence.

Independently of its application to the autogenous soldering of lead, the flame of the aerhydrique blow-pipe may be applied directly in using for solder, either the common alloys or pure lead, to unite zinc and iron, and lead, with iron, copper, and zinc.

It may be substituted also, with the greatest advantage, for the common blow-pipe and the lamp of the enameller, in all their applications to the soldering and joining performed by the aid of these instruments, by jewellers, goldsmiths, tinmen, manufacturers of plated goods, of platina, of buttons, &c.

This will readily appear if we reflect that while hitherto the parts soldered must of necessity be carried to the flame, it is, on the contrary, the moveable flame that is here conducted at will by the hand, to all the points that are to be exposed to the action of heat, whatever may be their position. On the other hand, the jet of the aerhydrique blow-pipe being susceptible of infinitely greater power, may be applied to works of much larger dimensions, and on this ground it may be usefully employed in certain

cases, by braziers, copperplate workers, locksmiths, tinmen, &c. As the sphere of action of the heat necessary to effect the fusion of the metal, can always be limited at will, one need never be afraid, while welding or soldering one part, of melting the part adjoining, and hence a very great facility in finishing a multitude of delicate articles, and above all, in effecting repairs that were heretofore impossible.

The applicability of this mode of soldering to the tubes of locomotive engine boilers, is deserving of particular notice. Not only can the flame be conveyed to the parts required to be soldered with great convenience, but the flame is free from those sulphureous admixtures which are unavoidable when the metal to be soldered is brought into contact with the vapours of burning coal.

There is another peculiar application of the flame produced by the combustion of gas, that has been effected by M. de Richemont, which it is not irrelevant to mention here; it is that of heating, by this means, soldering irons, such as those used by tin plate workers, zinc workers, plumbers, tinmen, &c. A few seconds suffice to bring the iron thus heated to the desired temperature, and it can be kept at that temperature for whole days without being liable to burn, the workmen having nothing else to do but to regulate the flame by means of cocks, and not being obliged to change his iron, or even to leave it for a single moment. Hence a considerable saving in manual labour, to say nothing of that in fuel, which will vary with the comparative value of the gas that can be procured, and that of coals, but which, in Paris, for instance, will be always one-half of the present cost.*

Lond. Mech. Mag.

On the Production of Electrotypes. By Alfred Smee, *Esq., Surgeon.*

The mode of taking copies of medals by the galvanic current† is deservedly occupying much of the public attention, and each is striving to add his mite to the perfection of this elegant and useful process. There are two or three points to which I am desirous of drawing the attention of your readers, as they appear to open a new and important field for investigation for which I have not the time at present. With regard to the precipitation of the copper, I beg leave to submit a modification of a plan first proposed by Mr. Mason, in a paper read before the Electrical Society, but I believe also contemporaneously used by other persons, that of making copper form the oxygen side of the battery, which being dissolved, is again thrown down at the platina or hydrogen end upon the medal or mould placed for its reception.

The mode which I adopt is, first to obtain a long dish or trough, and then to place a wire in the inside along its bottom, which is connected to the zinc of one of the cells of my battery along the opposite side of the vessel; a large piece of copper is placed in connexion with the silver of the battery, and a solution of sulphate of copper is then added. By this ar-

*It is calculated that in London if the common gas which is employed for lighting the houses and streets, be used for heating soldering irons, the cost for each workman during a day's work of twelve hours, would not exceed three halfpence, and for each zinc worker two pence halfpenny.

† We learn from the foreign journals, that Professor Steinheil, of Munich, is applying this process for making a cast in copper, from a composition by the celebrated sculptor Schwanthauler, representing the labours of Hercules, and containing 140 figures.—Edit.

rangement the current is generated at the zinc, passes to the medal, reduces the copper whilst the oxygen and acid are transferred to the refuse copper, and dissolves a corresponding quantity of copper, and by this means the solution is always kept saturated with the metal.

When medals are to be copied, they are singly placed in contact with the wire in connexion with the zinc of the battery, and in this way many may be done in the same vessel, and any may be taken out and examined without the slightest interruption to the others. The rapidity of the process may be increased without detriment by the use of two to six, or even more, cells of the battery, as the copper will still be extremely tough. It will be found that my battery will require not the slightest alteration, except once a day, when the liquid should be changed. I have tried other solutions of copper, such as the nitrate; but although the process is hastened, the metal is apt to be brittle, or to have other imperfections.

When engraved plates are to be copied, the first copy is in basso relievo, and therefore a second is required to be made, which is in "intaglio," and then ready for printing. Copies may even be taken of non-conducting substances, as wood cuts, &c., by brushing them over with black lead, taking care that the copper wire is in good contact with the plumbago.

The great advantages of this mode of proceeding above all others, are, first, the quality of the copper is far better than when reduced in the usual way, as described by Messrs. Spencer and Solly. This advantage is owing, first, to the use of the copper at the oxygen end, as suggested by Mr. Mason; secondly, all the plates or medals, for there is no limit to the number, are in the same vessel; thirdly, the process may be hurried or retarded, accordingly as the number of plates of the battery are increased or diminished; fourthly, the plates will not require to be interfered with till the precipitation is completely finished; and there are many other more trifling advantages, which it would be tedious to enumerate.

The mode of proceeding here detailed differs but little from others which have been described; but these trifling differences are so important in practice, that this mode will probably supersede every other. In fact, I have had the pleasure of seeing many most valuable copperplates subjected to this process, and the specimen which accompanies this paper is, I believe, the first which has ever undergone the ordeal of having the large number of impressions, required for any publication, printed from it. Of course it is a perfect fac-simile, and therefore this method would be of the greatest importance to bankers for their notes, and is far superior to Mr. Perkins' process for the multiplication of plates, because in that case they almost invariably require to be touched up afterwards, and therefore absolute identity is destroyed. The cost of their manufacture would be trifling, being merely the value of the zinc* dissolved in the battery, and a pound of zinc, of the value of sixpence, would produce a copperplate weighing about two pounds; and I trust that copper will again, from its beauty, take the place of steel engravings.

So much for the precipitation of the copper; and the next thing to which I have to direct your attention, is a mode of making a copperplate engraving without an engraving in the first instance. This is done by drawing upon a smooth piece of copper (such as a plate used for engraving) with any thick varnish or pigment insoluble in water, and then exposing the plate in

* The zinc in the fluid might be precipitated as a carbonate, for which there is great demand in the arts, and thereby the expense of the electrotype would be further diminished.

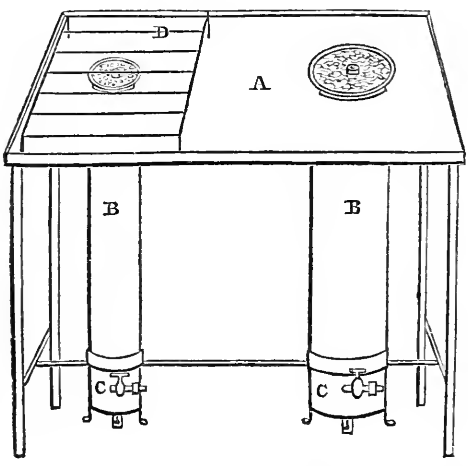
the usual way to the influence of the current, when first copper will be thrown down upon the uncovered parts, and will gradually grow over the drawing, and the electrotype, when removed, will be ready for printing. A practical difficulty, however, arises in the application of this in the arts, for unless very thick oil paint is used, sufficient depth is not obtained to hold the ink. However, judging from the sharpness of the edges of the lines, I have but little doubt that this difficulty may be overcome by those who are accustomed to drawing; and it possesses, as an additional advantage to its cheapness, the valuable property of not requiring the artist to reverse the design. An opposite effect to this may be produced by placing a piece of copper similarly drawn upon at the oxygen end of the battery, when the metal will be acted upon, leaving a drawing in basso-relievo.

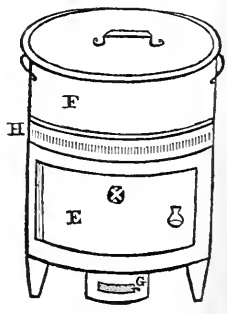
Bank of England, April 21, 1840. Lond. & Ed. Philos Mag.

Ricketts' Gas Cooking Apparatus.

Sir,—I send you herewith a rough sketch of a gas cooking apparatus, made for me by Mr. Ricketts, Agar street, Strand, London, which appears more useful, and certainly very much more economical in use, than the one described by your correspondent Mr. Weller; for I have a round tea kettle with concave bottom, and in this I can boil over my 5 inch burner, 4 quarts of water in 15 minutes, consuming 2 feet of gas, value one farthing. My portable oven will bake as well as any epicure can wish; it will hold 10 lbs. of meat, and the boiler above it 2 fowls and a vegetable tray; it is heated at the same time and from the same burner as the oven, consuming 8 feet of gas per hour; thus cooking a substantial family dinner for about two pence. My smaller burner consumes 3 feet of gas per hour, and this I find very useful for stewing. Yours, most obediently, P. O. CONNER.

Dublin, March 25, 1840.





Description of the Apparatus.

A, an iron table, 2 feet 4 long, 1 foot 2 wide, and 2 feet 8 high.

B, B, diluted gas burners for uniting a jet of coal gas with atmospheric air.
C, C, cocks with unions for attaching to the gas supply pipe.
D, iron stand or trivet for stew pans, tea kettle, &c.
E, portable oven.
F, tin boiler, with steam tray inside for vegetables.
G, small wove wire door for lighting burner.
H, fret work between top of oven and bottom of boiler, for escape of heated air.

Lond. Mech. Mag.

Mr. Charles Hancock's new process of Coloured Picture Printing.

We have been much gratified by the inspection of a proof-print of a picture painted, engraved, and *printed in colours*, by a new process, (so as to present a perfect *fac simile* of the original,) by Mr. Charles Hancock, the eminent animal painter. The subject is deer stalking in the Highlands. A huntsman in tartan costume, is about to let slip two magnificent looking stag-hounds, in pursuit of a herd of deer, seen scampering off in the distance, along the base of a range of precipitous cliffs, just lit up by the rays of the morning sun. A subject better calculated to show off the merits of the new process—from the great variety of bright colouring which it embraces—could scarcely have been selected; and in point of execution, it does, in every respect, great credit to the talents of the artist. The change from colour to colour, and the gradations of tint in each colour, are effected with as nice a resemblance to nature as if they had been done, not by a machine, but with infinite skill by the hand and brush. Indeed no person could, from mere inspection, discover any difference.

The process by which this important result has been obtained, and for which Mr. Hancock has procured letters patent, we shall now very briefly describe.

An outline is first etched and transferred to as many plates as there are positive colours in the picture, and any required gradations of light and shade in each colour, are produced upon the plate assigned to that colour, which is done by any of the ordinary modes of engraving. The different plates are then printed from in succession, with the colours appropriate to each, the chief care required being that of adjustment, so that one impression shall not, in the slightest degree, overlay another.

To the publishers of prints, this process is of great and manifest advantage. Two or three engravers can, by means of it, work simultaneously from the same picture, and a greater number of copies can be produced in a given time than has ever hitherto been done by any other process—much better copies too, inasmuch as prints coloured after nature are superior to prints in the ordinary black and white (supposing both to be equally well printed.) The cost of each series of plates is not more than that of one plate engraved in the usual way, (the metal only excepted) while against the extra expense of working there is to be set the entire saving of the print colourer's bill, for daubing in the wretched flare-up style which the shop windows have made familiar to the public.

This process will probably be found equally valuable to some of our manufactures—in the ornamenting of china for example; paper-hangings, cottons, silks, and other useful and ornamental fabrics; particularly as the process can be applied to surfaces engraved in relief, and printed at a type press, as well as to the ordinary modes of copperplate engraving and printing.

Ibid.

Notices from the French Journals. Translated for the Journal of the Franklin Institute, by J. Griscom.

Portable Match-bougies.

M. Chaussard, one of the most industrious gilders of the Capital, (Paris) has just patented a charming little affair which must soon come into general use, for it will be as convenient an article to the workman, the artist and the gentleman, as to people of fashion. It consists of a small case, not more than half an inch in diameter and three inches long, and of course as easily carried in the smallest pocket and held in the fingers as the most delicate snuff box. Within is a quantity of phosphoric matches and of little bougies. You take off the cover, hold it between the fore and middle fingers, take out a bougie, place it in a little opening in the cover which supports it, then draw out a match, rub it lightly on the case, the end of which, carved into concentric circles, produces a friction that kindles it. The bougie is lighted and the case being closed, you hold in the hand a veritable little wax candlestick, with a light which will burn for five minutes, and of course long enough to go up stairs and to light up a room, to read a letter, which any one may hand you of an evening in the street, to hunt for an object dropped in a dark place, to render assistance in an infinity of cases in domestic life when a light is suddenly wanted,—in a carriage, in a stage, to kindle a fire, light a candle, &c. &c. If both hands are wanted for any of these purposes, the match case may be placed on the floor, on a table, or in the chimney, and it stands quite secure. The price of these little utensils is very moderate, and within the reach of all. Rec. Soc. Polytech. Jan. 1840

(We have not seen any of these handy little affairs, but trust it will not be long before they will be common in our shops. Trans.)

Interesting Facts in Acoustics.

M. Jobard, a skilful artisan, states the following fact:

"An iron rule of considerable size, was left by chance resting on a bladder partly filled with gas in my laboratory. I happened to hit it in passing, with a hard body, and was surprised at the long continuance of the sound which escaped from it.

I repeated the experiment, and ascertained that a metallic rule, supported on one or two moist bladders, filled with air or gas, had its vibrations not more rapidly weakened or checked than if it had been freely suspended in space.

We may even derive from it various kinds of sounds, by varying the intensity and place of the strokes.

Other occupations have prevented me from pursuing the experiments. I suppose that a metallic organ key, (clanier) supported by two thin tubes of caoutchouc, filled with air, would give the same results as a piano à cordes, and that it would better preserve its accordance." Ibid.

Absolute Alcohol.

M. E. Soubeiran, at the conclusion of an article on the rectification of alcohol, gives the following direction:

"If you wish to obtain absolute alcohol easily, abundantly, and economically, it must be first rectified over carbonate of potash, which will bring it to 94° or 95°, thus:

1. Bring it to 97° by distilling it with 100 grammes (= 155 grs. troy) per quart of fused chloride of calcium, or, letting it digest on 2325 grains per quart of quick lime, in a warm place for two or three days, and then distil slowly from 3875 grains per quart of quick lime.

2. Add to the alcohol at 94°, 7750 grains troy per quart of quick lime; leave them in contact two or three days in a warm stove, and then distil slowly. The lime communicates to the alcohol no unpleasant taste or odour, as some have imagined and written; that happens only when the alcohol has not been previously rectified.

After this has been done over the alkaline carbonate, such an effect need not be apprehended, and the alcohol obtained has all the qualities that can be desired." Jour. de Pharm. Jan. 1839.

On the influence of native Magnesia (Giobertite) in the germination, vegetation, and fructification of Plants. By Angelo Abbene.

It has been thought that the presence of magnesia may be numbered among the various causes which render land sterile, because it has been remarked that magnesian soils have an arid character. This opinion has begun to lose credit since Bergman, on examining the composition of fertile soils, considered magnesia as one of their principal constituents.

Professor Giobert has made many trials to discover the parts which the native magnesia acts that is found in several arable lands. In the vicinity of Castellamonte and Baldissero, this substance is abundantly diffused, in soils which are cultivated with great success, and on which a vigorous vegetation prevails. There are many localities in Piedmont and other places, where the double carbonate of lime and magnesia abounds in cultivated territories, which produce beautiful crops. Giobert has inferred from these experiments, 1st, that native carbonate of magnesia is not adverse to the fruition of plants; 2nd, that in consequence of the solubility of the magnesia in an excess of carbonic acid, the earth may exert an action analogous to lime; 3rd, that a magnesian soil may become fertile when used with the needful quantity of manure employed.

The consequence which naturally flows from these facts is, that the magnesia has been dissolved in an excess of carbonic acid and water, and enters, like lime, into the composition of the sap, and ought to be found in the plant like potash, lime, oxide of iron, &c. This M. Abbene has assured himself of by the analysis of the ashes of plants which vegetated in magnesian mixtures. He has also tried by comparative experiments the question, whether the influence of magnesia in vegetation is analogous to that of lime. The conclusions which he thinks are deducible from these trials are:

1st. Native magnesia is not unfavourable to the germination, vegetation, and fructification of plants, but appears favourable to these functions.

2nd. Magnesia, being soluble in an excess of carbonic acid, exerts an action similar to lime, and when a soil contains magnesia not sufficiently carbonated, a remedy is found in the addition of manure, which, by its decomposition, furnishes the needful carbonic acid. The amelioration will be the more efficacious if the land be well stirred up, because the air will then better perform its office.

3rd. When in arable soils both lime and magnesia exist, the first is absorbed in preference by plants, because it has a greater affinity for carbonic acid.

4th. In sterile magnesian soils, it is not to the magnesia that the sterility is to be attributed, but either to the cohesion of their parts, to the want of manure, clay, or other ingredients, to the great quantity of oxide of iron, &c.

5th. Sterile magnesian soils may be fertilised by means of calcareous substances, such as plaster, chalk, ashes, marl, &c., provided the other conditions are attended to. Ibid.

Dilatation of Oils. By Prof. F. Preisser, *of Rouen.*

On the 27th of March, 1838, M. M. Levavasseur Frères, of Rouen, foreseeing a rise in the price of oil, purchased a quantity, partly of seed and partly of fish oil, amounting to 4232 hectolitres, which were stored in the magazines. On the 14th of July the Octroi took a fresh account of the oil, and found that instead of 4232 it amounted to 4279, hectolitres 40 litres.—Granting 30 hectolitres 40 litres for inevitable loss and waste, there remained 17 hectolitres (about 450 gallons) which could not be accounted for, and these merchants were accused by the Octroi of a fraudulent introduction of this excess.

Prof. Preisser being consulted on the case, he undertook an investigation of the amount of dilatation which oil undergoes by a given rise of temperature. He found, by several methods of trial, that in rising from the freezing to the boiling temperature of water, olive and linseed oil expands one part in 1200, and whale oil one part in 1000. Neats foot oil expands one part in 980, oil of colza one in 1120, nut oil one in 1100, and white oil one in 1250.

Thus it appeared, that in taking into account the mean difference in atmospheric temperature between the time of storage and subsequent measurement of the oil, the quantity in excess was at once accounted for by the natural expansion of the mass.

The calculation for finding the increase of volume of any number of hectolitres (and of course other measures) for a given difference of temperature, is extremely easy: it is only to divide the number of measures by the coefficient of increase, stated as above, for one degree of temperature, and to multiply the quotient by the number of degrees constituting the difference of temperature.

The above facts show the imprudence of completely filling barrels with oil in winter, and leaving them unmoved through the summer. The oil must necessarily find its way through the joints of the casks, or otherwise burst the containing vessel.

The same principle is applicable to other liquids. The coefficient for alcohol is $\frac{1}{900}$.

By attending to these facts, errors of opinion, and perhaps expensive lawsuits, may be avoided. Idem, Fev., 1839.

Development of Odours.

Every one is acquainted with the rotation which a piece of camphor undergoes in water, and the explanation of the fact which usually ascribes it to the

disengagement of the odorant vapours which exhale from it. It is known also that the leaves of the *schinus molle* placed on water, forcibly retract when the surface of the water is covered by a layer of odoriferous oil. M. Morren has just observed a similar phenomenon produced by the volatile oil secreted by the down of the *passiflora fœtida*. When some of the down or hair is placed under water, a small drop of green oil detaches from it, and swims on the water. This drop expands, contracts, expands, contracts again, then seems to burst with force, but the fragments unite to expand again a moment after, and thus the action goes on for about ten minutes, after which the oil is by degrees concentrated, and becomes motionless. These facts may serve, perhaps, to point out a physical theory of odours.

Idem, Avril.

Easy preparation of Anhydrous Phosphoric Acid. By RICHARD FELIX MARCHAND. (*Journ. für Praktische Chemie.*)

In a large porcelain dish place a small support, surmounted by the cover of a crucible, or a little porcelain capsule. Put into this capsule a few pieces of dry phosphorus, and place over it a large bell glass, with an opening at top, stopped by a cork, through which passes two tubes, the one large, and extending down almost to the capsule. It may be closed at top by a cork; the other narrow, and bent at an angle on the outside.

This narrow tube is to be connected with an apparatus for preparing oxygen gas—a retort in which chlorate of potash is heated, is perhaps preferable—though the most desirable mode is to cause it to issue from a gasometer, and to dry it completely by passing it over chloride of calcium and sulphuric acid. The oxygen gas must first be passed in, so as to expel the atmospheric air; then inflame the phosphorus, by passing a hot iron rod down the large tube. When all the phosphorus is burnt, more may be passed down the tube into the little capsule. The retort may be easily changed when all the chlorate of potash is decomposed. When the bell glass becomes too hot, the operation must be stopped till it cools, otherwise it will inevitably break. In this way, a very considerable quantity of the acid, almost pure, may be made in a very short time. With a quarter of a pound of phosphorus I have made more than half a pound of anhydrous acid. When the combustion is well managed, scarcely any vapours are disengaged. The flakes of acid attached to the bell glass and capsule may be quickly removed by a spoon. It must be preserved in well closed bottles.

Idem, Juin, 1839.

Rock Crystal Spun. By M. GAUDIN.

M. Gaudin sent to the Academy of Sciences, at the last (April) session, specimens of rock crystal, which he had succeeded in melting and drawing out into threads several feet in length, with the greatest ease. One of these can be wound into a skain, and the other wound round the finger.

M. Gaudin has found also, that melted rock crystal moulds easily by pressure, and that it is very volatile at a temperature a little above its melting point. Alumin acts very differently from silica; it is always perfectly fluid, or crystalized, and cannot be brought to a state of viscosity; while viscosity, separate from all tendency to crystalization, is the permanent condition of silica under the oxygen blowpipe. Alumin is much less volatile than silica; it often, however, undergoes ebullition.

In a more recent essay, M. Gaudin has tried the temper and relations of rock crystal, which has afforded unexpected results. If a drop of melted crystal fall into water, far from cracking and flying to pieces, it remains limpid, and furnishes good lenses for the microscope. When struck by a hammer, the instrument rebounds, and the lump will sink into a brick rather than break: its tenacity is such, that pieces can be detached only as splinters. It resembles steel in elasticity and tenacity.

Silicious compounds act nearly in the same way as rock crystal. The sandstone of the pavements spin off like it, with this difference, that its threads, instead of being limpid, are of a pure white, nacreous, silky, and chatoyant, in a singular degree, so that they might be mistaken for silk; and the globules, to a certain degree, have the aspect of fine pearls. There is no doubt that in this way successful means will be employed in producing imitations which will be preferred to natural pearls, since they will possess the hardness of annealed rock crystal, instead of that of a calcareous compound.

The emerald threads perfectly well, and its threads, which scratch rock crystal, are also more tenacious than crystal threads. Idem.

Separation of Lime from Magnesia. By J. W. Döbereiner. (*Journ. für Praktische Chemie.*)

If anhydrous chloride of magnesium be treated in contact with air, oxygen is absorbed, and the chlorine abandoned. This decomposition, that is, the transformation of chloride of magnesium into magnesia, is now prompt and complete when chlorate of potash is used instead of air.

This property renders the separation of lime from magnesia very easy. Dissolve the compound of these two bodies (e. x. *dolomite*, &c.) in hydrochloric acid; evaporate to dryness; heat the dried mass in a platina capsule till the acid vapours clear, and add to it, urging the heat to commencing redness, small portions of chlorate of potash, until there is no further disengagement of chlorine. The remaining mass is then composed of chloride of calcium, magnesia, and chloride of potassium, the separation of which is easily effected by treating the mixture with water, filtering the solution, precipitating the filtered liquor by carbonate of soda, &c.

Idem, Juillet, 1839.

Fabrication of Flint and Crown Glass.

On the 27th of January last, M. Bontems, director of the glass works at Choisy-le-roi, read to the Academy of Sciences a memoir, in which he described the process by which he succeeds in making flint glass and crown glass, exempt from streaks and bubbles, and perfectly white, (clear?)

M. Guinand had before succeeded in making flint glass without striæ, by working (brassant) the melted glass into a perfectly homogeneous mass. He accomplished this by means of cylinders of refractory earth, like that of crucibles. These cylinders, closed at bottom, were open at top, so as to receive forked iron rods, with which the mass of melted glass could be stirred as long as necessary, fresh rods being used as they grew hot. M. Guinand had thus resolved a part of the important problem of the fabrication of optical glass, but he left some of its elements in uncertainty. Guided by the experience of this skilful manufacturer, M. Bontems discovered that in making flint and crown glass, the absence of bubbles depends on the pro-

portion of the elements of the glass, and the arrangement of the fire toward the end of the operation. Thus far, also, fluid glass had attained a density of only 3.2 without injuring its clearness, (blancheur) while he has been able to give it a density of 3.6, and as clear as the most beautiful crystal; and crown glass as clear as that of Saint-Gobain or Saint-Quirin. He is preparing also to furnish opticians with disks of flint glass and of crown glass, of 40, 50, and even 60 centimetres (=2 feet nearly) in diameter. He appends to his memoir a plan of his ovens and crucibles, and points out all the details of his process. Idem, Mars, 1840.

On the Precipitation of Gold. By A. Morin, *of Geneva.*

Whenever gold is dissolved for any purpose in the arts, a notable portion of it remains in the mother waters, and various means have been recommended for extracting it. The principal substances used for this purpose are sulphate of iron, and formic acid, or the formiates of potash and soda.

Though the sulphate of iron is a low priced substance, compared with the formiates, the value of the metal is such, that the materials of higher price would be unhesitatingly employed, if they would extract the gold more completely. It may be interesting, therefore, to the workers in the metal, to know the comparative value of the two processes most generally recommended for its precipitation. I have attempted to resolve this question by treating the mother waters resulting from some preparations of this metal.

They were divided into two equal parts, each weighing a kilogramme, ($2\frac{1}{4}$ lbs. nearly) and as each contained a little more than two grammes (30.88 grains troy) they represented a solution of $\frac{1}{450}$ of the metal.

Into one I poured concentrated formic acid, until it acquired a decided acidity. The colour became a fine deep yellow. No gold was precipitated, even when heated. The formiate of potash tried with a small portion of this liquid diluted, showed no reaction. It was only when the liquid was half evaporated that metallic spangles appeared on the surface.

The addition of a few drops of caustic potash increased the quantity, and it was added as long as it increased the precipitate, which had the appearance of dark flocculi mixed with metallic spangles. It was soon deposited. The liquid was neutral and of a green colour. The farther addition of caustic potash gave no precipitate, and formic acid only changed the colour to a deep yellow. A fresh concentration produced no separation of the metal. The precipitate, washed and dried, was black. Heated to redness, it soon assumed the golden lustre. Its weight was 1.535 grammes. The washings and the mother waters were then mixed with a solution of sulphate of iron. An abundant black precipitate was formed, which I treated with muriatic acid with heat. It became of a clear brown, and very light. Adding more sulphate of iron, metallic spangles were formed, and it was continued till nothing more appeared. The deposit, washed with warm water, and then with acid, was dried and heated. It had the metallic splendour, and weighed 0.717 grammes, about one-half the preceding. United to the former, the weight was 2.252 gr.

This essay might appear sufficient to prove the superiority of sulphate of iron over the formic compounds; but I nevertheless tried the direct action of the sulphate on the other portion of the liquid, first acidulating it with muriatic acid, and heating it. The sulphate of iron was added as long as any precipitate appeared. At first violet, it passed to a clear brown. The pre-

cipitate was separated from the supernatant liquid, washed with water and muriatic acid, dried and reddened. It weighed 2.880 grs., sensibly equal to the two other precipitates.

The mother waters and the washings created were treated with formiate of potash, which occasioned no precipitate, even on the concentrated liquid.

These trials prove—

1st. That formic acid precipitates gold only when evaporated, so that the solution contains at least $\frac{1}{225}$ of gold.

2d. That the formiate of potash does this better than formic acid alone.

3d. That formiate of potash separates from a concentrated solution only about $\frac{2}{3}$ of its gold.

4th. That sulphate of iron precipitates completely from liquids containing only $\frac{1}{450}$ of gold.

Sulphate of iron, therefore, is complete, more easy, and more economical. Two precautions are nevertheless necessary for complete success—the use of heat and a notable addition of muriatic acid. Heat gives cohesion to the precipitate, which facilitates its separation. The acid accelerates the action of the sulphate of iron. Idem, Fev., 1840.

Phenomena observed with respect to Carbonic Acid, subjected to pressures superior to that of the Atmosphere. By M. Couerbe.

Water, at common temperature and pressure, dissolves about its volume of carbonic acid; and if the pressure is increased, the absorption is also; a volume of gas for each atmosphere, so that by means of a manometer, we learn the state of the interior of the vessel. The law, however, does not hold good for all pressures, and even at 5 volumes, the indicated pressure is often 7, the temperature being 15°, so that, in fact, a term must be arrived at in which the liquid must lose its solvent power, and the gas become nearly ready to assume the liquid state.

It follows, that gas, compressed over a given liquid, undergoes variable pressures, which are not always correspondent with the number of volumes dissolved. The nature of the liquid also causes a variation in the results.

The trials which I have made to come at a knowledge of the phenomena, were practised upon champagne bottles, in good condition, and which support about 20 atmospheres, a sufficient guarantee against fracture;—and yet, when wine ferments in them, we are struck with the damage which takes place in the course of a month, amounting, in the experience of some champagne merchants, to 15, 20, 30, 40, often 50, and even 60 per cent. Place a manometer, however, in connexion with the resisting bottles, and it scarcely ever indicates more than 7 atmospheres. The fracture, therefore, must be due to some other cause than pressure, or that the tension of the gas, for reasons I am about to furnish, suddenly increases, and transcends 20 atmospheres, the cohesive force of the glass.

Observation has proved to me, that in this liquid, the internal tension is very strong when it contains a little more than 5 volumes of carbonic acid; that even at 3 to 4 vols. it is great, and that between 4 and 5 vols., the bottles never break. The manometer indicates 7 atmospheres.

The cause of this appears to me to be attributable to the dissolving power of the liquid for the gas, which is variable at each pressure. The tension will be the more feeble as the affinity of the water for the gas is greater. Hence in a mixture of liquid and compressed gas, there are two forces in operation, the force of solution and the force of tension. When 3 or 4 vol-

umes are dissolved, the soluble force is weak, and cannot overcome the tension of the gas; at 4 to 5 volumes, the pressure is sufficient to bring the affinity of the liquid for the gas to its maximum, and to give the latter a tension equal to 7. At 5 volumes and more, the solvent power diminishes; the tension increases, surpasses the cohesion of the glass, which is equal to 20 atmospheres, and breaks it. These singular results seem foreign to all that has hitherto been known relative to the solution of gases in liquids.

It is proper, however, to notice what M. Soubeiran has said in his work on gaseous acidulated waters: "One fact worthy of remark, is, that notwithstanding the bad quality of the products, the gas contained in the bottles is sufficient to expel the corks to the end of the experiments, and yet, when we come to examine the liquid, we find but a small quantity of carbonic acid in it." This fact appeared to M. Soubeiran an anomaly, and he endeavours to explain it by saying: "The operator, by his dexterity, was enabled to enclose a portion of gas in the neck of the bottle, which accumulates there with sufficient intensity to drive out the cork, but there was no coincidence between the volume of gas retained in the water and that of its superior atmosphere."

The various phenomena above presented, may be assimilated to examples of another kind—the solution of salts in water. It is known that sulphate of soda is more soluble at 40° than at 20°, at 60°, &c., so that a line may be traced in a diagram through points which indicate the quantity of salt dissolved, and the temperature—a line which chemists call the *curve of solubility*. In the same way in the phenomena of gases, I think that a careful series of experiments might establish a curve of solubility of gases in liquids at given degrees of pressure, and that these apparently contradictory facts might be reduced to general laws. Thus the pressure over a solution of carbonic acid gas in certain liquids, acts absolutely like heat in a solution of salts in water—a correspondence which appears to me to be demonstrated by the experiments above detailed.

In the work referred to, M. Soubeiran gives a table of experiments which shows that agitation increases the tension of the gas; the difference is particularly marked at the beginning of the operation. "The agitation of the liquid," says the author, "constantly increases the pressure of the gas at the surface, and causes the water to lose a portion of the gas it held in solution." I may mention, that I made more than fifty experiments with bottles of champagne at 5 volumes, and that the manometer, which indicated 7 atmosperes, did not vary a demi-millimetre—therefore, if the observation of M. Soubeiran can be relied upon, the empty space modifies the phenomena according to its variable extent or dimensions. I say the empty space, because the experiments of Soubeiran were made with casks of 30 gallons of water, charged with 4 volumes of carbonic acid gas, and having a void space of $2\frac{1}{2}$ gallons at the surface.

In general, when a liquid like water contains several volumes of carbonic acid in consequence of increased pressure, the gas escapes almost instantly, as soon as the pressure is relaxed, and the liquid retains about a single volume; but champagne wine acts differently. As soon as the cork is withdrawn, about half a volume of gas escapes immediately, and the disengagement continues slowly till it amounts to a volume, and then stops; when a bottle may be left long uncorked without a total loss of gas. I am now supposing that the wine has been well prepared, and somewhat dried by tannin. This singular fact is owing to organic matter extending, in a kind

of network, through the vinous mass, and which condenses and retains the gas precisely like certain powders, and a great number of porous bodies, even under the common pressure of the atmosphere.—*Actes de l'Academie Royale des Sciences de Bourdeaux*, 1839.

Idem.

LUNAR OCCULTATIONS FOR PHILADELPHIA, OCTOBER, 1840.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
6	8	33	Im. d^3 Capricorni,	6	144°	151°
6	9	53	Em.		285	301
13	6	50	Im. η Pleiadum,	3	51	4
13	7	16	Em.		343	296
13	7	36	N. app. ☽'s limb 2′.2 N. of *h* Pleadium,	5,6		
16	16	19	Im. A Geminorum,	6	68	24
16	17	40	Em.		262	270

Meteorological Observations for May, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
⊗	1	56	66	29.60	29.56	W.	Brisk.	.05	Cloudy—showery.
	2	46	60	.70	.70	W.	Moderate.		Clear—do.
	3	50	74	.70	.70	W S.	do.	.03	Clear—rain.
	4	66	72	.20	.20	W.	Brisk.		Flying clouds—do. do.
	5	48	57	.46	.54	W.	do.		Flying clouds—do. do.
	6	44	58	.80	.80	N W.	do.		Clear—do.
	7	42	63	.80	.80	W.	Moderate.		Clear—do.
☾	8	43	66	.87	.87	N.E.	do.		Partially cloudy—do. do.
	9	42	43	.60	.56	E.	Brisk.	.90	Rain—do.
	10	40	48	.60	.66	N.	Moderate.	.05	Rain—cloudy.
	11	41	63	.80	.83	N.W.	do.		Clear—flying clouds.
	12	46	73	.83	.90	W.	do.		Clear—do.
	13	46	71	.90	.66	N.W.	do.		Clear—do.
	14	46	77	30.05	30 00	N.W.	do.		Clear—do.
☺	15	55	78	29.86	29.80	S.W.	Brisk.		Lightly cloudy.—do. do.
	16	58	79	.95	30.00	W	Moderate.		Fog—clear.
	17	56	84	30.10	.06	W.	do.		Clear—do.
	18	62	85	.00	29.94	S.W.	do.		Clear—flying clouds.
	19	62	80	29.90	.87	S.W.E.	do.		Clear—flying clouds.
	20	54	58	.90	.80	N.E.	do.		Cloudy—rain.
	21	56	62	.60	.60	N.E.	do.	1.10	Rain—do.
	22	56	72	.70	.80	W.	do.		Partially cloudy—clear.
	23	52	78	.90	.93	S E.	do.		Clear—lightly cloudy.
☽	24	56	62	30.05	.15	E.	do.	.45	Rain—do.
	25	57	75	.27	30.27	E.	do.		Cloudy—clear.
	26	49	75	.20	.15	E.	do.		Clear—do.
	27	52	81	.00	29.96	S.W.	do.		Clear—lightly cloudy.
	28	58	82	29.72	.75	S.W.	do.		Clear—flying clouds.
	29	60	85	.70	.65	S.S.E.	Calm.		Cloudy—clear.
	30	58	73	.70	.72	E.	Moderate.		Clear—partially cloudy.
⊗	31	62	83	.72	.72	W.	do.		Cloudy—clear.
	Mean	52.22	70.42	29.81	29.77			2.58	

	Thermometer.		Barometer.
Maximum height during the month.	85.00	on 18 and 29th.	30.27 on the 25th.
Minimum " "	40.00	on 10th.	29.15 " 24th.
Mean	61.32		29.84

JOURNAL

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MECHANICS' REGISTER.

SEPTEMBER, 1840.

Practical and Theoretical Mechanics and Chemistry.

Arts and Artisans at Home and Abroad: with sketches of the progress of Foreign manufactures. By Jelinger C. Symons, Esq., *one of the assistant Commissioners on the hand-loom inquiry, &c.*

[continued from page 81.]

Facts from Factories, and Sketches of the Produce in France and Belgium.

France.—The following are the prices of some of the chief muslin manufactures of Mulhause.

Jaconet 15°° 35 inches wide, chains No. 100s, weft 130s, 30 shots in the quarter of an inch. Sale price 1*s.* per ell of 44 inches. Wages for weaving, 5 sols. (2½*d.*) per ell.

2. A striped muslin 15°° 35 inches wide, 2 shots over for printing, was 1 fr. 50 cent. per ell (or 1*s.* 3*d.*;) of this considerable quantities were made, the weavers gaining between 6 and 8 fr. per week on them.

3. Fine calico 14°°, 35 inches, 2 shots over, warp much thicker than weft; very evenly wove cloth; 12 sols. (6*d.*) per ell of 44 inches. Calicoes range from this price to 10*d.* per ell, and some as high as 1 fr. 40 cent., according to the width.

Our manufacturers have not much to dread from Alsatian competition, excepting inasmuch as the protecting duties (which are the main cause of the backwardness of Mulhausen manufactures) prevent our articles from entering the French market. They are obliged to draw all their cotton through Havre or Marseilles, it being prohibited to them to have it from Hamburg, Trieste, or any foreign port, however much more convenient to

them. Coals also cost them exceedingly high:—(4 fr. 70 cent. per 100 kilogrammes, *i. e.* 3*s.* 11*d.* per 220 lb.)

The erection of a mill, machinery, &c. included, costs about 30 fr. (24*s.* 2*d.*) per spindle, and they calculate that a 30-horse steam-engine requisite for 18,000 or 20,000 spindles, consumes 2250 kilogrammes per day of 13 hours' work, and costs about 45,000 fr.

Previous to the modification of the prohibition of the import of foreign twist, the Mulhausen mills spun yarns up to No. 250s; but since our twist is admitted as low as 170s on the payment of a slight duty, they have ceased to spin any high numbers; a result for which the manufacturers give almost any reason but the true one,—namely, the incontestible superiority of the produce of Manchester and Glasgow.

The following are answers given by Mr. Schlumberguer, to some written questions which I put to him on the comparative economy, &c. of the French cotton-mills.

There are some very large spinning-mills at Mulhause, and in other parts of Alsace. They are, however, by no means in a flourishing condition, owing to various causes; among others, the high protecting duty, which the tariff of France imposes on the importation of foreign iron, in order, as I was told in Normany, to protect the monopoly of about fifty proprietors of indigenous iron mines.

The Messrs. MacCulloch, of Glasgow, have a finishing establishment at Tarare, the only one in that part of France; and, though their prices are said to be extremely high, they finish the Tarare goods in a style fully equal to that of Glasgow. They purchase all the fine yarn spun by Messrs. Houldsworth of Manchester which is sent to France, and supply the French manufacturers with it. Not only do the Tarare manufacturers find it their interest to pay the duty, carriage, and commission, on the finest yarns (above 170s,) but they buy all the yarns they use above 120s from Manchester also. It is sent sealed through France into Switzerland, paying the transit dues; and from Switzerland it is smuggled back again to Tarare by way of Chambery.

I have it on the best authority, and am prepared with evidence to its truth, that Tarare alone consumes L.40,000 Sterling of English cotton twist, one-third of which are Nos. below 170s, and consequently contraband; the rest in numbers up to 320s. The cost of smuggling these yarns into France varies from 30 to 40 per cent. on the value; which the "protecting duty" on the French manufacture gives to the Swiss smuggler, and certainly a very handsome present it is. It is impossible to converse ten minutes with a French manufacturer, without discovering some injurious effect of her benighted commercial system; and consequently of the infatuation of restrictions on international commerce.

I have already noticed the lowness of the hand-loom wages of Normandy.

I proceed to establish this, and the cheapness of the goods produced from patterns, and their prices, which I carefully collected at Rouen, &c.

1. Checked pullicate 10°° 33 inches by 30, Nos. 20, chain 35 weft. Wages 24 fr. for 16 dozen woven in about 20 days. Price per dozen 6 fr.

2. Do. 12°° 2 shots over. Turkey-red coloured check, best colour, yard square. Wages 39 fr. for 11 dozen. Sale price 13 fr.

3. Thick blue twilled calicoes for men's smock frocks, 10°° 45 inches

wide, coarse yarn. Wages 46 fr. for 120 ells, woven in 35 days. Price 1 fr. 86 cent. to 2 fr., 8 or 10 per cent. discount for cash.

These are gross wages: there will fall to be deducted loom-rent, fuel, light, agency, &c., which may be thus estimated, taking the article number 3 as a standard. 1. Agency 5 fr. (including the use of reed which the agent furnishes,) light and fuel 3 sols per day ($1\frac{1}{2}d.$) Other incidentals, wear and tear, &c. 3 fr. 50 cent. making 10 fr. 10 cent., which, deducted from the 46 fr. gross wages in 35 days, leaves as nearly as possible, 1 fr. per day or 5*s.* per week. This may be taken as above rather than below the average, which fluctuates according to the immediate demand, &c. &c., from 5 to 6 fr. weekly. Children and women are both occupied in weaving at proportionate earnings. About 4 fr. is given over the above for winding.

The manufacturers of Rouen pride themselves greatly on the superiority of these productions. And it is but justice to them to say, that I have seldom seen printed cottons so good, in colour and texture at 32 inches width for 7*d.* per ell of 44 inches, as those of Rouen at that price. They told me that they felt assured of being able very soon to compete in these articles with Manchester in third markets. I have before me a multitude of patterns from which these prices have been taken, and which I collected throughout the extent of my journey. These patterns I intend presenting to the Manchester Chamber of Commerce; and I cannot but recommend to the Government the duty incumbent on it to take means for obtaining periodical supplies of these patterns from every part of the manufacturing world. These are precisely the first duties a Government owes to the industry of a country; and are the protections alone due or useful to it; and at the same time those which our Government utterly neglects. The King of the Belgians has established a splendid gallery of models of all the first-rate mechanical inventions of other countries at Brussels, (many drawn from England:) it is constantly supplied with all new patterns, and artists have free admission. It is no slight stigma on us that we have nothing of the kind; if we except the interesting peep show at the Adelaide Gallery.

The silks of France have long been pre-eminent for their beauty, and any description of mine would be wholly superfluous, in a country where the produce of the Lyonese looms are abundantly known.

The number of looms in Lyons and its environs has fluctuated considerably. In 1788, a census, made by order of the consuls, gave 14,777 looms, of which 5442 were idle, owing to some sudden and temporary caprice of female fashion. The workmen of all sorts employed were 58,500. In 1801, the looms had fallen to 7000, owing to the war and other causes. In 1834, the number of looms was 17,281, of which 1358 were idle. The master weavers occupy about 7000, the compagnons 6854, and the children and apprentices 2300. This was the Prefet's estimate four years ago, and as many again were then estimated in the suburbs. Now a larger number belong to the latter, but the aggregate will scarcely be much increased.

The gross produce of the Lyonese looms was estimated in 1838, at 135 millions of francs value per annum.

The French beat us almost entirely in silks, through the elegance of their designs, and the rapidity with which they are produced. As I have already stated, this is wholly owing to their Schools of Arts institutions there supported liberally by the government; whilst here, the schools we have are both inefficient and trammeled with the absurdest regulations as to pupils adhering to the exact branch in which they enter, whatever difference of capacity they may afterwards exhibit.*

* I have learned from Mr. Wyse that this is now amended.

There are some very large cotton spinning mills in St. Quentin; those of Messrs. Houldsworth and Brewer, Englishmen, are among the largest; and several likewise in the vicinity, as well as in the Departement du Nord.

The Messrs. Tausin and MacCulloch (brother to the gentleman at Tarare) have here the largest finishing establishment in France.

In St. Quentin and the environs there are about 700 bobbinet frames; to each of these there are two workmen, whose wages do not exceed 1 fr. 50 cent. to 1 fr. 75 cent. per day. These descriptions of frames are scarcely sufficiently profitable to be worked at all, the demand declining constantly in this branch of the trade. There are, however, 40 or 50 Meckling frames, for the produce of which a considerable demand has arisen, and on which the wages amount to 6 and 7 francs per day. Several new frames are now making for this work, and, of course, both the profits of the manufacturer (at present immense) and the wages of the workmen will fall ere long. English yarn was exclusively used for these goods, but French yarn has come latterly much into use. The silk spinners now supply many of the Tulle manufacturers. I have heard, however, complaints that yarns are often sold for finer than they are, the length being deficient.

Bobbinet forms the only manufacture of Calais; it was introduced there from Nottingham twenty years ago, and the same machines for the common net continue to be used, which cost about L.100 each. There are about 400 of these machines in and near Calais, 100 of the fancy net machines, and 40 of what are called tatting machines.

A great number of these tulle weavers are Englishmen, who are domiciled at Calais. The tulle trade is very much on the decline there, with the exception of the fancy lace, which is made only by two houses, viz. Webster and Wragg, Englishmen, and Champoillon, a Frenchman; and although the trade in this article succeeds tolerably well at present, it cannot be said to be very brisk.

The cotton trade of France is much cramped by protecting duties. The production of the French mills will average 62,400,000 lbs. of cotton yarn per year. Mr. Schlumberguer, evidently lamenting over the fallen condition of his trade, writes, as we have seen, on the profits made by the French spinners:

"I confess I wonder how it is that the French spinners manage as well as they do, considering the fearful drawbacks they encounter. In the first place, about forty or fifty people have iron mines, and therewith a monopoly. All foreign iron is alone admitted at a high protecting, in effect a prohibitive, duty. This greatly increases the cost of machinery, and by rendering a large capital necessary to start business as an engineer, creates a *second monopoly* in machine making. Secondly, coal is protected, and Mons. Fauquet Lemaitre, of Bolbec, Normandy, assured me that he paid a duty on his English coal higher than the prime cost at Manchester. Then Le Havre and Marseilles have got their protection, and nobody in France, no matter on which side of it he live, can buy a single bale of cotton which has not paid harbour dues at one of these two ports: which, happening to be at the south and west of France, are of course peculiarly convenient for the extensive spinning mills established in the west and north. The whole commerce of France is, in fact, crippled and withered by these insane fetters."

Belgium.—The cotton manufacture in Belgium is said to represent a capital of 60,000,000 francs. Gand, Malines, and the district between these towns, is the locality of the cotton industry; Gand being the head-

quarters of the spinners. The produce of the looms amounted two years ago, to about a million and a half pieces of ginghams or coarse cotton and calicoes, and 400,000 pieces of printed cottons. An increase of about 20 per cent. has taken place since.

I had a long conversation with Mons. de Bast, of Gand, the president of the *Société Cotonnière*, to whom I was introduced by a letter from the king's private secretary. The following are among the most interesting of the various points we discussed, and of the subsequent observations I made at Gand.

The number of spindles in the cotton mills of Belgium, just before the revolution, amounted to 300,000 in Gand, and about 100,000 out of Gand. A diminution took place after that event, to which Mr. Baines alludes in his work on the Cotton Trade, p. 526, and the spindles in activity were reduced by at least 25 per cent., up to the 1st January, 1835, when 301,145 only were in activity. At the present time, the number employed exceeds 400,000. The steam engines represent about 1000 horse power.

M. de Bast was of opinion, that though the labour of individuals was cheaper in Belgium than in England, the advantage had been greatly overrated; because, first, the Belgian work people work like mere automata, mechanically, whereas, he believes, in England, they are far more skilled and interested in the art, and are able to explain the machinery, which they are not in Belgium. Again, he is of opinion, that owing *hitherto* to the decided inferiority of Belgian to English machinery, many more persons are needed in Gand than in Manchester to perform the operations which come in the class of preparations. This disadvantage is, however, on the point of being forthwith entirely removed; and new carding and drawing machinery, modeled on a combination of our best and most recent inventions, is now in progress for more than one of the largest mills of Belgium. I could not write a description of the mechanical difference to which I allude, but its effects may be understood by the diminution of labour it will cause in a mill of 18,000 spindles, and whereby 41 hands will suffice, where 72 are now employed. The fact is, that foreign manufacturers are only beginning to realize to themselves the full power which the cheapness of labour offers to them, by uniting it with the advantages of improved machinery, in the construction of which, they are abundantly aided by denizen engineers from England. In addition to new carding and bobbing frames, they are introducing self-acting mules.

Mules are almost universally preferred to throstles, (of which I saw but few abroad) owing to the much less power they require. They calculate that one horse power drives 500 mule spindles, but only 200 throstle spindles; and, as the object with them is the greatest possible produce, quality being a secondary consideration, they seldom adopt throstles at all.

In one mill in Gand, where I took an exact account of the produce, I found that each spindle produced 30 decagrammes per 72 hours of No. 30s; that is $\frac{33}{50}$ths of an English lb., equivalent to $19\frac{4}{5}$ hanks per week!

The drum wheel of a Gand cotton mill makes 150 revolutions, whilst with us it would make 130.

Mons. de Bast told me, that they frequently buy their cotton at Liverpool, in order to have a better choice. He complained bitterly of being unable hitherto to obtain a foreign market for their cotton twist, but he relied confidently on doing so when their new machinery was completed, which, he expects, will give an immense impulse to their trade. He believes that our corn laws will continually operate in increasing the facility,

and encouraging the progress, of foreign manufactures. All the continental manufacturers I met with spoke most joyously of the exceedingly small chance the English manufacturers have of getting the corn laws repealed. They speak of the landed interest in England in terms of great affection.

Flax forms one of the main sources of Belgian industry. The two Flanders produce alone, the value of 30,000,000 to 40,000,000 fr. per annum. The damasks of Courtrai, and many other towns, are too widely celebrated to require mention. Of common linen cloth, 750,000 pieces, value about 100,000,000 francs, were sold in 1836 in the different market towns in Belgium.

The spinning of flax by power is engaging the active attention of the Belgian capitalists, as well as of other nations. Mr. Cockerill, the iron king, of Liege, and who engages in nearly every department of industry in existence, has already a very prosperous flax spinning mill at Liege, of which the engine is of 90 horse power. Two more are building at Gand. We have not the same advantages for the purchase of the raw material as we enjoy in the cotton trade. Not only do France and Belgium produce the finest flax within sight of their rising mills, but the river Lys is invaluable for its bleaching qualities. The flax industry, first and last, employs 400,000 persons in Belgium.

Next to the linen, the cloth trade is the most lucrative of the textile manufactures of Belgium.

A capital of at least 80,000,000 is embarked in this branch; and about 14,000,000 are yearly expended in the purchase of foreign wool; the indigenous wool barely reaching a figure of 200,000 francs.

Verviers is the seat of the plain cloth manufacture, in which Mr. Cockerill is said to be much interested; and I saw, when there, another mill of gigantic dimensions, erecting by this individual.

A report from the Chamber of Commerce in 1833, represented the workmen employed there in the cloth manufacture to amount to 40,000; the annual production was calculated at 100,000 pieces of cloth, of a value of nearly 25,000,000 fr., or L.1,000,000 sterling.

In 1812, the trade and population of Verviers amounted to not one-half the present amount. The looms were one-half, but the produce has been tripled.

There is a very large carpet manufacture at Tournai, of 90 looms, where every description of carpeting is made. I was not able to get a sight of it, but I learnt the wages average 3 fr. per day for the good weavers, and 2 fr. 25 cent. for the second class. Seven-eighths of the whole produce are exported. The total length of carpeting produced annually averages 120,000 metres, or about 1,573,333 yards.

Mr. Smith, of Manchester, recently gave the following correct account of the extraordinary cheapness of the Saxon hosiery, which I have been at some pains to verify:—

"Saxony already manufactured as large an amount of cotton hosiery as G. Britain; and she exported 1,500,000 doz. pairs, while our export was only 430,000 pairs. Saxony exported to the United States about as much cotton hosiery as we exported to the whole world; and she not only exported to other foreign countries, but also to Great Britain. He held in his hand a beautiful specimen of Saxon made cotton hosiery, (a white cotton open-worked glove for ladies' wear,) such as he understood could not be made in this country; and for these gloves a hosier in Manchester gave 3s. 6d. per dozen pairs. He exhibited another beautiful specimen of hosiery, a stocking of fo-

reign manufacture, with one of similar quality, but English manufacture. The latter, a hosier at Nottingham told him, was there worth 6s. a dozen pairs; the price of the Saxon article at Hamburg was 3s. 2d. per dozen pairs. He next showed other beautiful specimens of stockings of a better quality, both Saxon and English manufacture; the price of the latter at Nottingham being 23s. a dozen, and of the former at Hamburg 12s 4½d. a dozen. With such facts as these before them, would any gentleman say that foreign competition was a farce? What ought we to say of the corn laws, when the Saxons could make articles at this amazingly low rate, and yet buy their yarn in the same market as the Nottingham manufacturers? The yarn from which these Saxon articles were made was spun in England, and sent out to Hamburg, and thence to Saxony; so that, in going out and returning manufactured to England, there was a carriage incurred for 700 miles, and yet they could undersell us on the very spot where the yarn was spun."

I endeavoured to penetrate the mystery which appears to shroud the cause of our inferiority, in spite of all our efforts, in the production of turkey red dye. The result was a conviction that there is no secret at all. It appears that we buy the drugs, the madder, the aligari, the gall, &c., generally in the same market with the Swiss; that we procure Swiss dyers, Mr. Bam Gardner, and sundry others, to instruct us and superintend the operation, but, nevertheless, we are beaten, and our colours will not "stand" like theirs; neither is the hue so brilliant. It strikes me that both air and water are against us, and that the mystery is much the same as that which renders ale brewed at Burton very different to the ale brewed at Edinburgh, and which would still be different were the same ingredients used at each place.

There is a good deal of dyeing done in Austria. The most beautiful hue of the dyes, in which the Continent excels us, are dyed at Trieste. I beg to call attention to the fact, that though, of course, the exact same materials are used, and the same process followed in other parts of Austria, yet the colour of the Trieste dye is so much and so notoriously finer than others, that it fetches a higher price in the market. This is, of course, owing to some peculiarity in the Trieste air or water, or probably both. Another proof that it is no undiscovered secret that accounts for foreign superiority in these dyes, is the fact, that the dye, even abroad, is never so good in winter as in summer.

The ordinary price of dyeing cotton twist the best colours, is 2 fr. 50 cent., or 2s. per English pound, both in France and Switzerland. Many of the Scotch houses send their yarns to Elberfeld to be dyed.

A young man was sent from a large establishment at Copenhagen to spend two or three years at Erberfield, Mulhause, &c., expressly to perfect himself in that art of dyeing turkey red. Since his return, he has been placed at the head of the dye works at Copenhagen, but has utterly failed in producing a dye of the same durability as those of Prussia and France. He says he is convinced the superiority of the latter dyes is entirely dependent on the peculiarity of the water and climate.

Physical Science.

To the Editor of the Journal of the Franklin Institute.

Account of a Tornado at Mobile, Alabama, on the 24th of March, 1840. *By* S. B. North.

Dear Sir,—However defective the following communication may be, I am in hopes the time and attention bestowed on this subject have not been misplaced. If any satisfactory information will be afforded the Committee on Meteorology of the Franklin Institute, my own gratification will be more promoted than their interests. Yours most sincerely,

Mobile, Alabama. Stephen B. North.

On the 24th of March last, a most destructive tornado passed over the city of Mobile. The day had opened with a clear sky; the weather warm and sultry, with little wind, which changed, about 2 o'clock, P. M., from W. by S. to S. W., when a considerable number of small dark clouds began to collect together in the western horizon in dense masses; and in half an hour, uniting with one common base, ragged in appearance, and here and there protruding out near the centre towards the earth, tapering to an obtuse point, similar to inverted cones. In a short time, these well defined cones were changed at their apex, and became elongated and twisted like a horn. With this exception, there appeared no probability of a change in the atmosphere, or the approach of a storm. Until 5 o'clock, P. M., the wind continually shifted from S.W. to S. by W., when it changed suddenly to W. by N., with increased force—the clouds black and lowering. At 6 o'clock, P. M., we had high wind from N.W., accompanied, for half an hour, with rain, and hail considerably larger than buck shot. The storm then abated for 15 or 20 minutes, after which it came on with renewed vigour, accompanied with hail nearly one inch in diameter; and by 7 o'clock, P. M., we had a hurricane of the greatest violence. The clouds were heaped, in the western horizon, in magnificent sublimity—the lightning flashed vividly, as if the whole atmosphere was overcharged with the electric fluid, and was preparing to unite its power with the other elements, and sweep every thing in its path—the thunder was scarcely to be heard for the wind, which roared furiously, and continued to increase until it blew a tornado.

Of the extent of the track of this storm, we have no positive information, but we believe it extended some distance in the interior of the country, where it was not so destructive in its effects. We, therefore, shall confine ourselves to the destructive influence exerted within the range of our observation, where we are able to appreciate the effects produced with tolerable accuracy.

We have visited and examined the scene of its greatest effects, and find the first impression of the tornado to have been about three miles from the city, in a north-easterly direction, in an open space of several acres, almost entirely cleared of trees. The desolating power of the hurricane may be estimated by the long line of wrecks for about two miles; houses were unroofed and prostrated—fences demolished—trees, of a considerable size, uplifted and overthrown, and others snapped off like reeds. There were several trees, from three to four feet in diameter, perfectly sound, twisted like the strands of a rope, about five feet from the earth, offering no more resistance to their triumphant enemy than reeds before the mower's path. By

measurement, the width of the tornado was 200 yards where it made its first impression, but through the city it gradually decreased to the river, a distance of three to four miles, to about one-fourth of its original width. The course of the tornado, from its supposed place of beginning, was ten degrees N. of W., and to where it terminated it did not vary ten degrees. The current was irregular in its violence, advancing in a succession of terrible gusts, sweeping, by its impetuous force, every thing it encountered in its path. It had an undulating, or wave-like, motion, horizontal with the earth's surface; or in other words, it seemed to have moved in bounds, sometimes receding from and approaching the ground—passing over some tracts, doing comparatively little damage, and then sweeping with renewed violence over others.

The first building the tornado encountered was Mr. Page's saw mill, which was struck at the north-western angle, removing a part of the roof, leaving untouched the remainder of the building. About sixty yards distant from the mill stood Mr. P.'s dwelling, 20 by 45 feet, well and substantially erected about four feet from the ground, upon large blocks of wood. It was entirely demolished, burying his wife, daughter, and son in the ruins, who, by the aid of the neighbours, were immediately extricated; but the life of Mrs. Page was found extinct, and the daughter seriously and the son slightly injured. The house seemed to have been lifted bodily, in an upright position, by the force of the wind, and after the storm had passed, to have fallen in the same position it originally occupied; but every stud, tie, brace, and corner post were separated from each other, and every tenon and mortise broke. The flooring of the house and piazza, with the joists, were all that remained without being separated. We are inclined to believe the destruction of the house may be traced to the rarefaction of the air on the outside of the building, and the explosive force of the air acting on it from within. The kitchen, detached from the main building, and distant only 20 feet, was left untouched by the storm—offering sufficient evidence that that part of the mill destroyed was on the edge of the tornado, the kitchen on the outside of it, and the dwelling in the centre of its effective power.

We predicate our opinion on the width of the tornado from the distance between Mr. Page's kitchen and mill and the trees on the opposite side brought within its effects, which space does not exceed 200 yards. After leaving Mr. Page's, it passed over a tract of about a quarter of a mile, leaving scarcely a trace of its path; then it encountered a knoll, thickly studded with trees, which were all prostrated—those lying in the centre uprooted and overthrown in the path of the storm, and those on the edge not uprooted, were shivered or twisted off at different elevations, leaving only a portion of their shattered trunks standing. We found the trees on either side lying at an angle of 30° towards the centre of the storm, with their tops in the direction of its track. The next point it encountered was the refectory attached to the nunnery, a frame building, 52 by 31 feet, substantially built, and distant about 600 yards from its last effects. It was entirely destroyed, except the roof, which, after the sides had been scattered in every direction, fell on the outside of the foundation, exposing two-thirds of the altar. The pupils had retired from the building a few minutes before the tornado struck it; the Lady Superior with several sisters had remained, and were about sitting down to their evening meal. They were all prostrated by the fallen timber around them, and were covered with the roof, which fell upon the benches, forming a sufficient barrier for their protection, against being

crushed to death. They all escaped without any serious injury. The gable end of a brick kitchen, 20 by 30 feet, attached to the nunnery, was forced out, and some of the bricks carried 150 feet, and other damage was done, but not sufficient to cause it to be entirely rebuilt. After passing over another tract, and continuing in terrible force, removing a portion of the residence of Lewis Judson, overthrowing one of his chimneys, and stables, and doing considerable damage to Mr. Williams' dwelling, tearing his fences and prostrating his trees—after this, its force was materially diminished, and was scarcely felt in the bay below, above the general high wind which had been prevailing.

Throughout the tract of the tornado, we have no evidence of any whirling motion having characterized it.*

M. Lévy on Haydenite and Beaumontite, two minerals from the United States.

M. Lévy, one of the most distinguished crystalographers of Europe, has recently read before the French Academy of Sciences, a notice of Haydenite and of another mineral accompanying it, which proves to be a new species, and which he has named Beaumontite, in honour of M. Elie de Beaumont. The Haydenite was first discovered in a gneiss rock near Baltimore, and was first described as a new species by Prof. Cleaveland in his Mineralogy, second edition, 1822. Although it has never been analyzed, it is a little singular that his high authority has been totally disregarded by the authors of later treatises on mineralogy in this country, who have classed it with chabasie. This is the case with Shepard and Dana. The latter erred, also, in saying that the mineral was found in trap rock; and M. Lévy does not seem aware that Dana has comprehended it within the species chabasie, mentioning the locality, and giving it a place, without any question as to its character, or even acknowledging it as a new variety of that mineral. We must now, however, give up to the high authority of M. Lévy, whose nice examination of its characters, and determination of its crystaline form, (incompatible with chabasie) fully establishes its claim to a new species. The opinion of Brooke, that the mineral in question was Heulandite, we can reconcile with the discovery of M. Lévy, only by supposing the pearly white crystals which accompany the specimens, to have been mistaken by him for the mineral called Haydenite by Cleaveland, and especially as they have been regarded as Heulandite in this country. This mistake would be quite natural if he had not Cleaveland's description before him as a guide; at any rate, we know Mr. Brooke's accuracy too well to believe that he would ever have mistaken the genuine Haydenite for Heulandite, after the slightest examination.

All that is now wanted to complete the natural historical description of this mineral, and the pearly crystals above alluded to (Beaumontite) associated with it, and to assign them a place in the systems, is an accurate analysis, which we hope we may have the pleasure of recording at no distant period. Dr. Hayden will, probably, be able to supply enough of both minerals for this purpose. We subjoin the following abstract of M. Lévy's remarks from the London and Edinburg Philosophical Magazine for Feb., 1840, p. 156:—

* We would query of our correspondent whether the fact of large trees having been twisted like a rope, is not an evidence of a whirling motion. G.

"The authors who have mentioned this substance have merely repeated what has been stated by Cleaveland. Mr. Brooke, in his article on Mineralogy in the Encyclopædia Metropolitana, classes, without assigning any reason, Haydenite with Heulandite. I will add what appears to me singular, which is, that in a work recently published in the United States, entitled a System of Mineralogy, by James D. Dana, and printed at New Haven in 1837, no mention is made of this species, though in other respects the work appears to be pretty complete.

"The cause of our ignorance respecting the nature of Haydenite may be explained by the small number of specimens which have been brought to Europe. M. Lévy then goes on to state that he had seen only three specimens of Haydenite, and the account he gives of it is as follows:—Haydenite is regularly crystalized: the crystals have the form of a small oblique prism with rhombic bases, in which the incidence of the lateral faces is 98° 22′, and the incidence of the base, on each of the lateral faces, is 96° 5′. The crystals are frequently macled. The axis of revolution, around which one of the two crystals forming the macle is supposed to have turned 180°, is perpendicular to the base of the primitive form, and the face by which the two crystals are united is parallel to the same base. The crystals are thickly grouped together, and a small portion only of each is isolated. I have observed no modification either upon the edges or angles, so that the relation between the sides of the base and the lateral edges remains undetermined. The crystals cleave with the same facility on every face of the primary form. The cleavage faces sometimes present an uneven surface on account of small dark spots, as if the substance had suffered incipient decomposition. The crystals are usually covered by a thin layer of hydrate of iron, which is readily detached by the knife, and the faces of the crystals thus exposed are sufficiently brilliant to be measured by the reflective goniometer. The colour of Haydenite is brownish yellow, or greenish yellow; the crystals are translucent and sometimes transparent, they are easily scratched by the knife, readily friable; the hardness is nearly the same as that of fluor spar. The quantity detached was too small to admit of its specific gravity being taken."

Beaumontite, a new Mineral.

"This interesting substance accompanies the Haydenite above described, occurring in small brilliant crystals of a pearly lustre. Their form is that of a prism with square bases, terminated by obtuse pyramids. The summits of all the crystals are closely grouped. The incidences of the faces of the terminal pyramids, measured with Wollaston's goniometer, are 132° 20′ of the two faces, the intersection of which is parallel to one of the edges of the base of the primary form, and 147° 18′ of the two faces above, whose intersection is inclined to this base. One of these angles is a necessary consequence of the other. By calculating from the first, the second is 147° 28′ instead of 147° 18′, as determined by experiment. The primary form of the Beaumontite may therefore be taken as a right prism with square bases, in which the relation between the sides of the base and the height is nearly as the numbers 23 and 10, and then the faces of the pyramid have b^1 as a crystalographical sign. The crystals cleave readily parallel to the lateral faces of the primary form, but more easily parallel to one of the faces than the other, and this greater facility corresponds with the pearly

lustre peculiar to them. There are also some indications of cleavage, parallel to the diagonal planes of the primary form, the crystalographical sign of which is g^1. The colour of the crystals is whitish yellow; they are translucent; their hardness is greater than that of Haydenite, and is almost equal to that of phosphate of lime.

"The crystals of Beaumontite and Haydenite form a crystaline layer, the brilliant portions of which belong to the first mentioned substance, and the parts covered with brownish hydrate of iron to the second. This layer covers a granular rock, composed principally of grains of quartz and Haydenite. The other face of the specimen is covered with small flat elongated prisms of green amphibole."

Bibliographical Notice.

The American Journal of Science and Arts.

This excellent periodical continues to be supported not only with undiminished vigour, but with an increasing amount of original and enriching communications from the gifted friends of science in our country. It has now acquired a veteran constitution, and is destined, we hope, to transmit to very distant ages, the fruits of American ingenuity, research, and discovery. It has not only gained, within the twenty-one years of its existence, an American and European, but, as far as the English language has been made the vehicle of knowledge, a cosmopolitan reputation. Its track of usefulness differs so materially and essentially from that of our own periodical, that we feel no other rivalship than those of good wishes and the most friendly desires for a permanent prosperity. Among the original articles, the most readable and agreeable in the last (July) Number, is one from the pen of the senior editor, Professor Silliman, on phrenology, containing the substance of his remarks at a meeting held for the purpose of offering complimentary resolutions to George Combe, Esq., at the conclusion of his course of lectures at New Haven in March last. Although we are still doubtful of the claims of phrenology to the place of a sisterhood among the *Sciences*, we are much pleased with the exhibition now made of the physiological analogies which may be advanced in defence of its rank and pretensions, as an object well worthy of popular illustration, and of the study of accurate observers. G.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1839,

With Remarks and Exemplifications by the Editor.

1. For *Dressing Mill Stones;* Shadrach Trumbull, Suffield, Hartford county, Connecticut, August 2.

The machine which is the subject of this patent is said to be applicable to the dressing, or pecking, of mill stones, and also to stones of other descriptions.

A round peck staff is prepared so as to have a steel chisel affixed in one end, and this staff is made to work up and down by hand in a stock, or slide, through which passes a guide rod, along which the stock may be moved

back and forth, horizontally. By means of another guide rod, the stock, with its peck staff, may be made to stand either vertically or obliquely. The whole apparatus is to be fixed on a platform, upon which the operator is to stand when using the instrument; and when this is so placed that the chisel will stand directly over, and the guide rod in, the line of, a furrow, the peck staff is to be worked up and down by hand. The claim is to "the combination of the ways, or rods, the stock, fork, and peck staff, or handle, as described."

The fact is, that there is but very little novelty in this machine; mill stones have been dressed by similar machines, in which the chisel was directed along the furrows by guide rods, although under an arrangement different from that above claimed.

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2. For a *Counterblast for Blacksmiths' Fires;* William Sharp and Heman W. Sharp, Catherine, Chemung county, New York, August 2.

The wind from the bellows is to be blown into a wind-chest, from which two pipes are to proceed, leading to opposite sides of the fire. A valve, or sliding shutter, is made to divide the wind-chest into two parts between the two pipes leading to the fire, so that the blast may pass either through one or both of these pipes at pleasure. It is stated that the double blast has been before used, and is not, therefore, claimed; but the claim is confined to the manner of governing the blast by directing it through one or both pipes, as may be desired.

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3. For a machine for *Packing Flour;* James Banta, Utica, Oneida county, New York, August 2.

There is, we think, much novelty in the piston of this flour packing machine. Said piston consists of a hoop, of the proper size to enter a flour barrel, and the circular disk within this hoop consists of six, or any other convenient number of, valves, or shutters, which fill up the space between the hoop and the centre, they are hinged by one edge to the hoop, and to the piston rod in the centre, opening downwards, and when closed constitute a flat piston. The piston rod receives a rotary motion, and is also worked up and down by means of a crank, during the time of packing. When this operation is to be commenced, the piston is allowed to descend to the bottom of the barrel which is to be packed; a quantity of flour is then put in above the piston; the rising of this allows the valves to open and the flour to fall through, whilst by its descent and revolving motion, the flour is packed; the operation being continued until the barrel is filled. The piston rod and its appendages are contained within a frame, that slides vertically within an exterior frame, or guide posts, and this interior frame is allowed to descend at every stroke of the piston.

The claim is to "the mode herein described of packing flour by means of the piston head with valves, and having a vertical reciprocating and horizontal rotary motion, all as herein described." We see no reason why this plan should not succeed well, provided there is not a tendency in the valves to clog, and with a dry article, like flour, this, probably, will not be the case.

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4. For a machine for *Splitting Leather;* Horace White, Binghampton, Broome county, New York, August 2.

There is a large number of leather splitting machines, most of which ope-

rate upon the same general principle, the claims set forth by their improvers being to certain special devices invented by them. The claim, in the present case, is to "the manner of combining the cylinder with the knife, or cutter, by bringing the knife near to the cylinder, so that as it revolves, the leather shall be carried by it against the knife; and regulating the knife by means of screws, so that it shall, in combination with the cylinder, gauge the thickness of the leather to be cut."

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5. For a *Rotary Steam Engine*; John Drummond, Elizabethtown, Essex county, New Jersey, August 3.

After a description of considerable length, the patentee limits his claim "to the mode of attaching the revolving head, or piston, to the rotary shaft, by means of an arm of the form described." It is acknowledged, therefore, that the novelty is but small, and as in a good rotary engine the novelty must be very great, we shall not occupy the time and space necessary to particularize the mode of fastening above claimed.

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6. For a *Cattle Pump:* Andrew Bailey, Jefferson, Ashtabula county, Ohio, August 3.

We have often remarked, that when we meet with a proposed improvement on pumps, we anticipate but little, as the requisites to a good instrument of this kind are well understood, and well supplied. It frequently happens, therefore, that the proposed improvement manifests a want of knowledge on the principles of hydraulics, and of an acquaintance with what has been practically effected. Among the various schemes which have been proposed, that now placed before us is one of the most absurd, as it presents a very troublesome mode of arriving at sure defeat. A cylinder, twenty-eight inches in diameter, and a foot deep, is to be placed in the reservoir from which the water is to be raised; this cylinder, or tub, has a bottom furnished with a valve opening upwards, to admit water. A piston is to be made of wood, two inches thick, which, when leathered, is to fit the cylinder. To this is to be attached a hollow tube which is to constitute the piston rod, and through this tube the water is to rise. The piston is to be forced down by causing an animal to ascend an inclined plane, or platform, bearing on the piston rod, and when said animal retires, the piston is to be raised by means of a weight passing over a pulley. In the tubular piston rod there is a valve opening upwards; the water is to flow into a trough.

The claim is to "the hollow piston rod in combination with the trough, platform, and the piston, cylinder, and valves, of the ordinary pump."

This will be a most effectual mode of applying the principle of the hydrostatic paradox to the bursting of the cylinder, or tub, or rather to the destroying of the twenty-eight inch piston of two inches in thickness, and to the forcing out of much more water round its packing than will find its way through the hollow piston rod.

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7. For an improvement in *Piano Fortes:* William Cumston, Boston, Massachusetts, August 3.

The object of this improvement is to stop the vibration of one of two strings, in instruments having two unisons to each note, without the lateral shifting of the hammers, and this is to be done by causing wedges, or mutes, attached to a bar, to descend between the strings of each note.

The claim is, first. "The checking of the vibrations of the strings by the

interposition of wedges, or mutes, between them, the wedges being arranged on a beam, as described. Second. I claim a beam made to descend by its own weight, by being loaded, or constructed of metal. Third. I claim the arrangement of the arms and levers, which, in combination with the lever pedal, produce the descent of the beam."

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8. For a machine for *Sizing Paper:* William W. Wilson, and Chas. Dickerman, Westfield, Hampden county, Massachusetts, August 3.

This machine is for dipping paper in the sheet into a circular tub, or vat, containing the sizing liquor. Instead of dipping it by hand, the paper is to be held in clamps at the lower end of slides set round, and carried by the revolution of a vertical shaft, said slides having counter weights attached to cords passing over pulleys.

"In using this machine, the workman employed in sizing the paper may dip all the respective portions successively without moving from his station, by merely causing the shaft and its appendages to revolve, in consequence of which arrangement a much larger quantity of work may be performed than by the ordinary apparatus."

The claim is to "the placing of such slides in such a manner as that they may be carried round by a revolving shaft in an apparatus constructed substantially in the manner and for the purpose set forth."

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9. For improvements in a machine for *Pricking Leather, preparatory to Stitching;* Samuel Sheldon, Cincinnati, Ohio, August 3.

A machine bearing considerable resemblance to that which is the subject of the above patent, had been in use, but the patentee has made certain improvements in the arrangement of its parts, by which it is rendered more convenient in use; these are represented in the drawing, and claimed by reference thereto.

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10. For an improved *Portable Soda Water Fountain;* Samuel B. White, Cincinnati, Ohio, August 9.

This patent is taken for using with a portable soda water fountain a large stopper which screws into its upper side; this stopper has a chamber within it for containing the exact quantity of the powder intended to be dropped into the vessel for producing the effervescing mixture, which powder falls by the pressing down of a rod. The claim is to the particular arrangement of the parts of this stopper.

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11. For *Window Blinds;* Alonzo S. Grenville, and Thomas J. Lewis, Cambridge, Middlesex county, Massachusetts, August 9.

The claim under this patent is to "the method of opening and closing blinds by means of the combination of pullies, cords, and sliding blinds, in the manner described."

These blinds are called railway blinds, as they are to run on wheels, or pulleys, in the manner of sliding sashes. There are to be pullies in the window frames, around which cords pass from the interior of the room, and which are attached to the blinds on the outside of the window; by this arrangement the blinds can be opened and closed without opening the window.

12. For a machine for *Cleaning Wheat*, &c.; Thomas M'Crea, Anne Arundel county, Maryland, August 9.

This machine consists, principally, of two circular cast iron plates, having teeth on their faces; one of them forms a horizontal bed, and the other revolves above in the manner of a mill stone. The claim is to "the method of arranging the teeth of the two cast iron circular plates so that the teeth of the upper plate shall revolve between those of the lower plate."

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13. For a *Cooking Stove*; Elihu Smith, Troy, Rensellaer county, N. York, August 9.

The claim under this patent is to "the attaching a stove, or portable oven, having a grate under it, in which a separate fire may be made whenever necessary, to a cooking stove as herein described, so that both, when combined, shall form a cooking apparatus, in which either fire place may be used as occasion requires. Also the movable compound grate, as described in connexion with the cooking apartment of the stove, by means of which the capacity of the grate for holding coal is enlarged, and the plates of the fire place in a manner protected from the action of the fire; also the movable grate as described, in connexion with what I have termed the fire apartment," &c.

The particular arrangements above referred to are shown in a number of figures, and described at considerable length, but cannot be readily made known by description only.

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14. For a machine for *Washing Clothes;* I. Leavitt, Adnah Gilmore, and William Sturdevant, Turner, Oxford county, Maine, Augus t9.

The claim is to "the combination of two fluted cylinders with the concave bed of rollers on which they act, and also the combination of the rocker with the bed of rollers, as described."

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15. For a machine for *Shelling Corn*; Lester E. Denison, Saybrook, Middlesex county, Connecticut, August 12.

The specification of this patent is of considerable length, and the construction is such as to require the aid of the drawings for its explanation. The claims are to a "shelling cylinder placed within, and in combination with, the revolving, concentric, cylindrical rest and the segment concave. Also the revolving concentric cylindrical rest, constructed in the manner described."

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16. For *Sawing Staves;* Royal E. House, Choconut, Susquehanna county, Pennsylvania, August 12.

In this machine the saws are to be bent so as to adapt them to the curvature to be given to the staves transversely, and it is so constructed as to admit of staves of different curvatures being cut on the same machine.

A shaft is placed horizontally with journals resting on suitable bearings. This shaft carries two bars, or arms, of metal, which stand out from it at right angles, parallel to each other. These arms must be of a length sufficient to carry the saws for cutting hogshead staves. To one of them is attached a shackle bar, operated by a crank, so as to give them a vibratory motion. Upon these arms are placed clamps which are to hold the ends of the saws, and these clamps may be placed at any required distance from the shaft. For a vessel eighteen inches in diameter, they would be placed

at the distance of nine inches, and the ends of the saws confined in them by means of jaws fastened by screws. Two saws being so placed, form, with the clamps, a circle of eighteen inches in diameter. Suitable carriages are to be used for feeding the bolts, or stuff to be sawed, up to the machine.

The claim is to "the sliding saw clamps, changing the diameter of the saws to suit the work required; and the scales on the beams to graduate the position of the saw clamps, as described."

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17. For a *Pump*; James Pike and William Fisk, Cumberland, Rhode Island, August 13.

"The principal improvements which we have made are intended to facilitate the supply of water through the lower valve, and to provide a more convenient way of letting off the water, by opening both the valves, than has hitherto been attained, in order to prevent its becoming frozen in the pump in cold weather."

The lower part of the chamber of this pump, which contains the lower valve, is enlarged, say to double the diameter of that part in which the piston works, giving an opportunity of making the valve openings larger than ordinary, and also making room for the apparatus by which the lower valve is to be raised for letting out the water, which is effected by raising the pump brake higher than it is raised for pumping, thus bringing a rod attached to the piston into contact with a lever that raises the lower valve, and, by a similar operation, raising the upper valve: the arrangement is simple, and must be effective. The patentees do not claim to be the first to have invented a mode of opening the two valves, but claim their "mode of effecting this object, that is to say, the manner in which we have constructed and combined the sliding valve, its rod, and lower piston plate, with its shank, or rod, so as to act upon the lever, and raise the two valves simultaneously, as set forth; also, the forming of the enlarged chamber for the purpose of containing the lower valve, increasing the water way, and admitting the apparatus concerned in the opening of the valves, as described."

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18. For machinery for *Drying Grain and Seeds;* Richard Else, Great Britain, August 14.

"The peculiar feature of novelty, or improvement, which I claim to have invented in apparatus or machinery for drying corn, grain, or seeds, is the lanthorn, or skeleton cylinder or drum, covered with wire work, or reticulated fabric, and having reticulated ledges for turning over the corn, grain, or seeds, and allowing the steam evolved during the operation of drying to escape freely; whether the said drum be made perfectly cylindrical or polygonal, and whether covered with wire gauze or perforated plates of metal, or other material, and in whatever manner the same may be mounted and made to revolve, provided the same be made available to the purpose of drying grain, or seeds." The drum containing the seeds is to be placed, and made to revolve within, a suitable stove, properly heated. The ledges spoken of extend from end to end of the drum, and are composed of double perforated plates, or reticulated laminae, standing at an inch or two apart, and extending to a considerable distance from the surface towards the centre, by which the position of the grain is constantly changed, and a large evaporating surface obtained.

19. For an improvement in *Stoves*; Judson B. Galpin, New Haven, Connecticut, August 14.

This improvement is a device for increasing the radiating surface; and for that purpose two flat pipes are made and convoluted so as to resemble the scroll of an Ionic capital, and these are so placed, on each side of the stove, as that the draught shall pass through them and escape through pipes connected with the inner end of each convolute. The claim is to "the convoluted pipe, or pipes, combined with the stove and horizontal drum, or with the stove alone, substantially in the manner set forth."

These pipes will be troublesome to make, and when made, they will inevitably collect a quantity of dust which it will not be easy to remove; moreover, there will be but little advantage resulting from them, as their main radiating surfaces will be opposite, and near to each other, and the rays of heat will not, therefore, be directed into the room.

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20. For an improved machine for *Punching Metals;* Samuel H. Brown, Wheeling, Ohio county, Virginia, August 14.

In this machine, the punch is to be forced down by the raising of one end of the lever, on which it is fixed, by the action of a cam; this cam is made to operate upon a system of friction rollers, to lessen the friction, and the claim made is to "the arrangement of the rollers, in combination with the cam lever; that is to say, placing the two rollers on which the cam acts, in a box or carriage, which travels on another set of rollers, in the manner described."

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21. For a *Machine for Propelling Machinery;* Ammi West, Greene, Kennebec county, Maine, August 16.

The title of this patent induced a suspicion that the machine which is the subject of it, would not prove to be a valuable present to the useful arts, and an examination of the specification and drawings has fully confirmed this impression. The most direct and simple mode of applying power is usually the best, and that before us contains an array of levers, ratchets, endless chains, &c. &c., through the intermedium of which the power of a man is to be applied to propel other machinery, and that in the manner of the tread mill. There are two treadles upon which the man is to stand, and which he is to depress alternately. From each of these treadles rises a pitman, the upper end of which has a hook upon it. The hooks of these pitmen are to catch upon the joint bolts of two endless chains, passing round chain wheels, by the axes of which wheels the other parts of the machine are to be driven. The claim is to "the employment of endless chains in combination with the dogs and treadles, as a substitute for ratchet wheels heretofore employed," &c. The whole thing is unworthy of further remark; and if one such machine has been made and tried, it stands self condemned.

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22. For a *Molasses Gate;* Jonathan D. Kellogg, and Justus Wright, Northampton, Hampshire county, Massachusetts, August 16.

This molasses gate is constructed much like the common cock, having a conical pin turning within a socket, in the ordinary manner; instead of a hole, or mortise, through this pin, it is cut entirely away on one side, so as to leave an enlarged way for the flow of the molasses. The socket has no nose attached to it, for the delivery of the liquid, but has a hole in it for the fluid to pass through. The claim is to "the rotary valve in combination

with the hollow cylinder, or truncated cone, as described." Were we to speak phrenologically, we should say "novelty small."

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23. For an improved *Ever-pointed Pencil Case*; John Hague, city of New York, August 16.

In this pencil case, the pencil is to be protruded by the sliding of an outside tube, which covers the slot on the tube within it, and the claim is to "the mode of protruding the point by a middle outside tube, the whole constructed and operating as set forth;" the precise arrangement would require the drawings for its illustration.

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24. For a *Spark Arrester*; Henry Wilton, Wrightsville, York county, Pennsylvania, August 17.

The general principle upon which this spark arrester is constructed is the same with several which have preceded it, but with some variations and additions in the combination. The smoke flue is to be surrounded by a casing, leaving a space between the two for the reception of sparks. The cap is to be covered with wire gauze in the usual manner, and in front of it there is to be a funnel-formed opening, to collect the wind which is to drive the sparks back into a conductor leading down to the space between the flue and its case. At the lower part of the chimney there is to be another funnel-formed opening leading into the flue, and, of course, crossing the space between it and the case; this is said to be for increasing the draught of the chimney, which we apprehend it will fail to effect.

The claim is to "the combination of the funnels, prism, and conductor with the ordinary flues, cap, and wire gauze, for preventing the escape of sparks at the top of the chimney; also the funnel in the inner flue for increasing the draught."

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25. For *Furnaces for Smiths*; Edward Nichols, Hampden, and James Augur, New Haven, New Haven county, Connecticut, August 21.

This is more properly a forge than a furnace, and is particularly intended for the burning of anthracite. In its construction it differs but little from such as have been before used. It consists of the chamber for containing the coal, and a wind chamber below this, into which the blast is to be blown. The whole is to be made of cast iron, and the fire chamber is to be lined with fire brick; at the lower part of this there is a drop grate, by which the coals are allowed to fall into the wind chamber, and from this they are discharged by a close fitting door. This door forms the bottom of the wind chest, and is connected to the drop grate by a jointed rod, in such manner as that the lowering of the door causes the drop grate also to descend.

The claim is to "the manner in which the drop door is combined with the grate; by which, when the door is opened, the grate is let down."

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26. For improvements in *Railroad Switches*; John C. Post, Morrisville, Bucks county, Pennsylvania, August 21.

"The nature of this invention and improvement consists in a certain combination and arrangement of connecting rods, cranks, wrists, crankshafts, and movable rails at the turnouts, added to and combined with the ordinary switches; and likewise certain additional wheels suspended to the locomotive by swivels, cranes, or otherwise, for depressing the movable rails at pleasure for shifting said switches."

The claim made is to the particular combination of the respective parts above referred to, and it will be readily apprehended, from the enumeration, that we cannot attempt to give a verbal explanation of the proposed system in our monthly list.

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27. For a *Rotary Steam Engine and Pump;* William H. Baker, and Samuel H. Baldwin, Cohoes, Albany county, N. York, August 21.

This instrument, which is to be used either as a rotary steam engine, or as a pump, is to operate in the same way with such as have been before essayed. Two cylindrical segments are to revolve within a case having concave ends exactly adapted to them; each segment is about a semi-cylinder, and on its axis is another semi-cylinder of half its diameter. By gearing upon the axles, on the outside of the case, these segments are made to revolve with equal velocities, and in such manner as that the larger cylindrical segment of one has its face in contact with the smaller segment on its fellow. So far the plan is old; the claims point to what are esteemed the novelties in the improved construction, and these are to "the mode of keeping the joint tight between the segment pistons as they revolve, by means of the segment or cam gearing on the axles of the segment pistons, which gives to the pistons equal velocities as they revolve; and to the arrangement of the parallel metallic packing against which the segment pistons revolve, regulated by screws from the outside of the chamber, in combination with the hemp packing at the sides of said metallic packing, as described."

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28. For a machine for *Bending Tire*; Aaron Whitcomb, Choconut, Susquehanna county, Pennsylvania, August 21.

"The nature of this invention consists in arranging a lever between two short posts, erected in a strong bench, or block, whose fulcrum is a strong bolt passing horizontally through said lever and posts, and in having a segment block, a segment of the circle to which the tire is to be bent, secured to the under side of the lever, immediately below the fulcrum of the same, and in having a loose clevis attached to the shorter end of the lever by a horizontal pin passing through the clevis and lever, which clevis holds the tire against the surface of the segment." The claim is to "the method described of bending tire by means of the segment block, in combination with the lever and clevis, as described."

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29. For a *Dovetailing Machine;* Ari Davis, Boston, Massachusetts, August 21.

This is an ingeniously contrived, and a well operating, machine for making dovetailed tongues and grooves on the ends of boards, for forming boxes, and other articles requiring to be similarly jointed together. The joints are to be mitre joints, and upon one of the boards the mitre is formed with a dovetail groove along it, and upon its corresponding piece, a dovetail tongue. These mitres, tongues, and grooves, are cut by circular saws fixed upon movable standards, in such a way as to be capable of exact adjustment. The claim is to the described manner of constructing this apparatus so as to cut the mitre, and the tongue, or groove, at the same time.

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30. For a machine for *Ventilating Rooms;* James M. Burton, Salem, Clarke county, Georgia, August 17.

This ventilator, or rather blowing machine, consists of two inverted vessels, dipping into water, in the manner of gasometers. These are furnished with valves to let air into them as they rise, said air escaping through tubes, leading to the apartment to be ventilated. The air vessels are to be worked up and down alternately, by means of geared machinery, to be propelled by a weight, all of which is of the ordinary character of such machinery. The claim is to the bellows, water vessels, and tubes, constructed and operating as described. Should either novelty or utility in the machine be inquired after, we, at least, should be at a loss to point it out.

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31. For a *Bridle Bit;* Dan. S. Balch, Bradford, Orange county, Vermont, August 23.

"The nature of my invention consists in a revolving spool, with deep collars upon the ordinary bit, for reducing friction, or rubbing, against the mouth of the animal."

An iron wire, or rod, about a quarter of an inch in diameter, passes through the tubular perforation in an iron spool, which spool is about five inches and a half long, and about five-eighths of an inch in diameter; its two ends are formed like the ends of a spool, used in cotton spinning machines. Each extremity of the centre wire is bent so as to form an eye, and receives a ring, in the ordinary manner. The claim is to "the combination of the wire bit and revolving spool, constructed as described; reducing the friction of the bit against the mouth of the animal to which it is applied." In what way it is to operate to reduce friction we are not told, and it certainly is not very obvious.

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32. For improvements in *Manufacturing Soap;* Arthur Dunn, Great Britain, March 23.

(See Specification.)

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33. For an improved *Screw Wrench;* Henry W. Hewett, Troy, Renssalaer county, New York, August 24.

Claim. "I do not claim as my invention the sliding jaw moved by a screw and nut, as this has been known; but what I do claim as my invention is the employment of the parallel bars with their lower faces beveled for the purpose of embracing the sliding jaw, of the form above described, and also the arrangement of the handle, nut, and screw on the other end of the handle, and passing the stem and screw of the sliding jaw between the parallel bars, and through the handle and nut, thereby strengthening the handle, all as herein described."

The sliding bar consists of two parallel bars, leaving a space between them about equal to their own thickness. The two inner edges of the lower side of this bar are champhered, so as, together, to form a dovetail; the sliding jaw occupies the space between these bars, and is widened out so as to fit the dovetail. The movable jaw is acted upon by turning the handle. The whole affair appears to have been well conceived, and the construction is such as to render it convenient and permanent.

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34. For a *Cooking Stove;* James Devine, Rochester, Genessee county, New York, August 24.

"The nature of my invention consists in raising the oven, which is in the centre, and over the fire, between two rows of boilers, so as to have them

directly over the blaze of the fire, and also interposing the dampers between the two plates of iron that separate the oven from the fire, so as to form a third plate, and thus protect the bottom of the oven from a too intense heat; and distributing and equalizing the heat over the oven by means of two dampers placed over the oven." This stove is peculiar in its form. The lower part of it is of the proper width for the fire place, immediately over which the oven extends from front to back, projecting up above the other portions of the stove, like a muffle, or wagon top. The boiler plates extend out as wings along the sides of the oven, the fire chamber curving out to make room for the cooking vessels. The claim is to this particular arrangement, and to that of the dampers.

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35. For an improved method of *Making Sulphuric Acid*; James Hargraves, Paterson, Passaic county, New Jersey, August 24.
(See Specification.)

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36. For improvements in *Fire Arms;* Samuel Colt, Paterson, Passaic county, New Jersey, August 29.

The guns and rifles made upon the plan invented by Mr. Colt, are very extensively known. The present patent is obtained for various improvements in their construction, which we cannot make subjects of description, nor would the claims, without the numerous drawings, be of any value in furnishing a knowledge of the different improvements; we shall, therefore, pass the whole over.

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37. For a machine for *Drilling Metals, &c.*; Elisha Hall, Byron, Genessee county, New York, August 24.

The claim made under this patent is to "the mode of forcing and drawing out the drill; that is to say, the having the drill stock embraced by a hollow cylinder, with a screw cut upon its outer surface, and supported at each end by a puppet in which it works, all as described."

A patent for a drilling machine was granted to William Ray Jones, of Granville, New York, on the 11th of January, 1836, which, from a model restored to the office, appears to be the same in principle, and nearly identical in construction, with that of Mr. Hall. The papers relating to this patent were burnt in the office, and it has not been restored for record, or probably the claim of Mr. Hall would have been rejected.

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38. For a machine for *Cutting Sausage Meat*; G. D. Mettetal, Pittsburgh, Pennsylvania, August 24.

This machine consists, mainly, of a cylindrical body revolving within a hollow cylinder, and carrying leaves, or wings, placed obliquely, which force the meat to be cut against rows of knives, and at the same time carry it from the feeding, to the delivery, end of the machine. The principal novelty in this machine is the manner of affixing the knives, which are confined in place by wedges, similar to those used for plane irons, and this mode of fastening is claimed, as is also a device for shortening the machine by means of two plates of metal, which, when put in place, fit against the revolving cylinder and the interior of the cylindrical case.

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39. For an improvement in *Water Wheels;* Thomas Ruble, St. Mary's, Adams county, Indiana, August 29.

The water wheel here referred to is of the horizontal, reaction, kind, and the improvement claimed is "a curved shoot in combination with a straight shoot;" a device which we apprehend will leave the action of the wheel unaltered, or rather unimproved, and is not, therefore, in our opinion, worth the trouble of explanation and discussion.

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40. For *Water-proofing and Napping Cloth*; William K. Phipps, Framingham, Middlesex county, Massachusetts, August 31.
(See specification.)

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41. For *Supplying Ink to the Pens of Ruling Machines*; Lewis Edwards, Norwich, New London county, Connecticut, August 31.

The ink is to be contained in a trough extending along at the heads of the pens, and into this trough one edge of a piece of cloth is to dip, whilst the other portion of the cloth lies upon the pens, and supplies them with ink, by capillary attraction. Lines may be ruled with differently coloured inks, at the same time with the ordinary lines, by means of small cups of coloured ink placed within the trough, and having a strip of cloth leading from it to the pen, or pens, to be supplied. The claims are to this particular mode of giving the supply.

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42. For an improvement in the *Wicket Gates of Canal Locks;* William L. Potter, Clifton, Park, Saratoga county, New York, August 31.

The wicket gates are to be double, each part consisting of a plate of cast iron, or other material, of sufficient length to extend nearly from side to side of the lock gate, and wide enough, when placed together, to cover an opening in the lock gate sufficiently large for the discharge of the water. These two wicket gates, when closed, form a parallelogram, divided by the line of their junction into two parts, which are nearly triangular, having one end much narrower than the other; these both work on joint pins at their narrow ends, their wider ends sliding in guide grooves. When opened, the lower section of said wicket is to be depressed, and the upper section raised, which is effected by two connecting rods, jointed at their lower ends to the wide ends of the wickets, and at their upper to a horizontal vibrating lever, having its fulcrum at the upper end of the lock gate. The claim is to "the combination of the two wickets, in the manner and for the purpose described."

Specifications of American Patents.

Specification of a patent for Wire Tiller Ropes. Granted to Isaac M'Cord, *Harrisburg, Dauphin county, Pennsylvania, July* 6, 1839.

To all whom it may concern: Be it known, that I, Isaac M'Cord, of the borough of Harrisburg, in the state of Pennsylvania, have invented a new and improved manner of manufacturing round, flexible, wire rope, which may be employed as tiller rope in the steering of vessels, and for other purposes where such flexible rope may be required; and I do hereby declare that the following is a full and exact description thereof.

For the purpose of making wire rope suitable for tiller rope, I take iron wire of the size of from No. 27 to No. 30, selecting that of the best quality, and this I anneal in a covered vessel, to protect it from the action of the atmosphere, in the usual way of conducting that process. I have, at the same time, prepared a suitable vessel containing train oil, which I heat to a temperature of from 200 to 300 degrees of Fahrenheit's scale, and when the iron has been brought to a red heat, I immerse it in the heated train oil, and suffer it to cool in that situation; the effect of this process is to give to each of the wires a complete coating of bright tenacious varnish, which not only protects it from rust, but gives it much greater flexibility than is possessed by iron wire prepared in any other known way. I have essayed flax-seed, and other oils, in the same way, without attaining the same end in an equal degree.

In converting the wire thus prepared into tiller rope, I take about sixty wires of the requisite length, usually from two to three hundred feet, and extend them out into a straight line, giving them an equal degree of tension. This constitutes one strand of rope. I take three such strands and attach them to a hook on a machine similar to that for laying hemp rope, and I also employ a "top," or grooved frustrum of a cone, for laying my wire rope, in a manner similar to that of laying hemp rope. But it is a point of great importance in the manufacturing of round wire rope, that there be no twist whatever in the separate strands, and such twist would be given to them in the ordinary process of laying; to prevent this, I connect each of the strands at their ends opposite to that where the laying commences, to three separate hooks on a wheel or apparatus used for twisting and laying ropes, and which is well known, and by means of this I give a countertwist to the strands during the whole operation of laying, to such extent as shall keep the wires in each strand in a straight line, or parallel to each other, continuing the operation until the laying is completed

I have mentioned the using of three strands for making my rope, but a larger number may be used if preferred. A rope of four strands will be more perfectly round than one of three, but from the same quantity of material, the latter will have the greatest strength.

Having thus fully described the manner in which I manufacture my round flexible, wire rope, what I claim as my invention, and desire to secure by letters patent, is the employment of the heated train oil in the process of annealing and coating the wire in the manner above set forth; and also the keeping of the wires of each strand without twist in the operation of laying, by giving to them a countertwist, as above described.

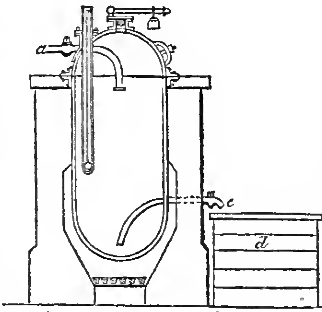
Isaac M'Cord.

Specification of a patent for improvements in the Manufacturing of Soap. Granted to Arthur Dunn, *of Great Britain, March* 23, 1839.

This invention consists, first, with reference to soaps generally, in boiling or heating the ingredients of which they are to be composed or manufactured, in close or covered steam-tight vessels, so that the saponifying process may be performed under steam pressure, and at temperatures exceeding the ordinary boiling points of the aforesaid ingredients, when they are mixed together and exposed to heat in open vessels, in the ordinary process of soap boiling; and secondly, with reference to those soaps in particular, of which silica is to form a component part, my invention consists in placing

silica, or materials containing silica, in the high pressure boiler with the other ingredients, as hereinafter stated, or in dissolving silica with caustic alkaline lees in a steam-tight vessel or digester, at a high temperature and under steam pressure, and thus producing a silicate which may be mixed afterwards with the ingredients hereinbefore alluded to, (when required to make silica soap) as hereinafter described; and, whereas, the manner in which my said invention is to be performed is as follows:—

I take the ingredients for making soap, and in the usual proportion, say, for instance, in order to make common yellow soap, seven hundred weight of tallow, three hundred weight of palm oil, three hundred weight of rosin, and about one hundred and forty to one hundred and fifty gallons of caustic soda lees; specific gravity, about 1.10, or containing 11.5 per cent. of real soda, and place the whole in a steam boiler, such as shown in the annexed cut. The boiler should be furnished with a man hole, safety valve, and all the ordinary appendages of such an apparatus, with a thermometer plunged in a mercury chamber. There should be a feed pipe as at *a*, and a discharge pipe as at *c*, through which the soap may be discharged into a pan, or frame, as at *d*. The fire being lighted, the pressure on the valve should be such as to allow the temperature in the boiler to rise gradually to about three hundred and ten degrees of Fahrenheit; when it has remained at this heat for about one hour, the ingredients may be discharged from the boiler into the pan, or frame, and allowed to cool down, when the process of saponification will be found to have taken place.



I will now proceed to describe the manner in which I dissolve the silica, when I am about to make silica soap with silica in that state, and which I do previous to adding it to the other ingredients, whereby I am enabled to determine the quantity of silica to be contained in the soap, or sufficiently so for all practical purposes.

This, which constitutes my second head of improvement, consists simply in putting silica, whether in the state of ordinary black flints, broken to the size of half a cubic inch, or thereabouts, or in combination with other substances with caustic alkaline lees, in the proportion of about 100 weight of silica to one hundred gallons of lees, of the specific gravity of about 1.10, in a steam-tight boiler, with apparatus such as hereinbefore described, and heating the same to a temperature above the ordinary boiling point of such lees, (say about three hundred and ten degrees of Fahrenheit) keeping the ingredients under steam pressure of about fifty or seventy lbs, on the square inch, for about three or four hours, when it is discharged and cooled down; and I obtain a silicate of soda, or potash, according to the alkali used in solution, the strength of which can be ascertained by chemical analysis; and this solution, when silica soap is to be made, may be added in any quantity to the other ingredients when in the pan, or frame, after they have undergone the saponifying process before described, and before they cooi down dependent on the per centage of silica required to be in the soap.

Now whereas, I claim as my invention, first, performing the saponifying process of soap making, by heating the ingredients of which the soap is to be composed, in a steam-tight boiler as aforesaid, at the increased temperature

aforesaid, and under pressure as aforesaid; and, secondly, digesting silica in a similar boiler at a high temperature and under pressure aforesaid, and then mixing it with the other ingredients in the pan, or frame, as aforesaid, whereby I am enabled in the first case to cause the perfect combination of the ingredients required for making soap in a much shorter time, with less waste and at a less expense than heretofore; and, in the second case, to cause silica to combine more readily with soap, and to ascertain more accurately the quantity of silica to be contained in silica soap.

ARTHUR DUNN.

Specification of a patent for an improved method of manufacturing Sulphuric Acid. Granted to JAMES HARGREAVES, *Paterson, Passaic county, New Jersey, August* 24, 1839.

To all whom it may concern: Be it known, that I, James Hargreaves, have invented a new and improved method of making sulphuric acid; and I do hereby declare that the following is a full and exact description of the method of making the same:—

I cause the sulphur to be burnt in a pan, in a close furnace, by fire below the same; and the vapour arising from the combustion of the sulphur is forced and driven, by a blast of atmospheric air from the furnace, through a tube leading therefrom to a close receiver filled nearly full of water, and discharged near the bottom of the receiver, in such manner that the vapour ascends through the water to its surface, and by combining with the water, forms sulphuric acid. I also cause the vapour to be met by a blast of steam and atmospheric air while yet in the furnace, and before passing into the receiver, to cause the vapour of the sulphur, or sulphurous acid, to combine with one more equivalent of oxygen, a dry atmosphere being unfavourable to the combination; and the vapour, after passing through the water in the first receiver, rises through another tube fixed in the top of that receiver, and passes through another receiver in the same manner, and so through a third, or more, as may be found expedient; and as the acid in a concentrated state is drawn from the first receiver by a cock at the bottom, the weaker acid from the second receiver is drawn into the first, and that of the third into the second; and thus the water being placed in the last receiver, passes through the several receivers, becoming more and more concentrated, until it is drawn from the first receiver in the form of sulphuric acid.

In order to render the process more effectual, I insert, in the receivers, horizontal shelves, to cause the vapour to pass a greater distance through the water, and these shelves, as well as the receivers, should be covered with lead. The blast of atmospheric air may be made with a cylinder with double blast, or in any other manner to make a steady and uniform blast, and the blast of steam may be made by a boiler over the sulphur furnace.

What I claim as my invention, and desire to secure by letters patent, is the manufacturing sulphuric acid in the manner herein set forth, viz. by introducing a blast of air to force the vapour of the burning sulphur through the water in the receivers, and by introducing a jet of steam with atmospheric air, into the furnace, to meet the vapour of burning sulphur, as herein described.

JAMES HARGREAVES.

Specification of a patent for a method of making Cloth impervious to water, and of adding a Nap thereto. Granted to William K. Phipps, *of Framingham, Middlesex county, Massachusetts, August* 31, 1839.

Be it known, that I, William K. Phipps, have invented, or discovered, a new and useful method, or process, for making cloth impervious to water, in combination with adding a nap thereto, which I call *talipot cloth*, of which the following is a true, full, and exact description:—

I take a piece of linen, woolen, or other cloth, and laying it on a table, or other smooth and even surface, I apply to it, with a brush, or other suitable instrument, a thin coating of liquid cement, or composition, in an even and uniform manner over its whole surface. The cement I use for this purpose, and the one I consider to be the best, is linseed oil mixed by boiling with some kind of drier, as gum shellac, red lead, and litharge, one pound of each to a gallon of the oil; or the oil may be used as a cement without any drier, in which case the cloth will be longer drying. I usually colour the cement of the same colour the nap is intended to be.

Having thus applied the cement, I take the material of the nap, viz. flock, or the shearings of woolen cloth, the same that is cut off by the cloth dressers in shearing the same, or other description of material, for nap, and scatter it evenly, by sifting or otherwise, over the surface of the cloth, and then let the cement dry. The cloth, when dried, may be dressed in the manner of other cloths, having a nap of similar description.

I call it talipot cloth. It forms an excellent and cheap material for the covering and lining of carriages; for storm coats, and for various other purposes.

What I claim as my invention, and ask a patent for, is the mode of adding nap to cloth in combination with the mode of rendering cloth waterproof, in the manner above described. William K. Phipps.

Specification of a patent for an improvement in the mode of constructing Railway Tracks, or Rails, to enable cars to turn short curves. Granted to Henry M. Naglee, *Philadelphia, Pennsylvania, August* 26, 1840.

To all whom it may concern: Be it known, that I, Henry M. Naglee, of the city of Philadelphia, in the state of Pennsylvania, Civil Engineer, have invented a new and useful improvement in the mode of constructing, or forming, railway tracks, by means of which improved construction, railway cars and carriages are enabled to run round short curves at the corners of streets, and in other situations, with greater facility than by any other known plan; and I do hereby declare that the following is a full and exact description thereof.

Where curves are to be formed in railways for the purpose of enabling railroad cars and carriages to turn round the corners of streets, or in other situations where it is necessary that such curves should be of much shorter radius than that usually admitted on railway tracks, I construct a rail, usually of cast iron, which rail is to constitute the convex side, or rail of largest radius, in such manner as that the wheel which is to pass around it will run either upon its ordinary tread, or upon its flanch, and will thereby adjust itself to the designated curve. The inner rail of the curve, or that of

shortest radius, may be the ordinary edge rail, or any of the other rails in common use, which may suit the particular location of the curve.

Fig. 1, in the accompanying drawing, is a cross section of the cast iron rail, and of the wheel thereon, drawn to one-half of the actual size. The wheel being shown, as sustained, and running upon its flanch.

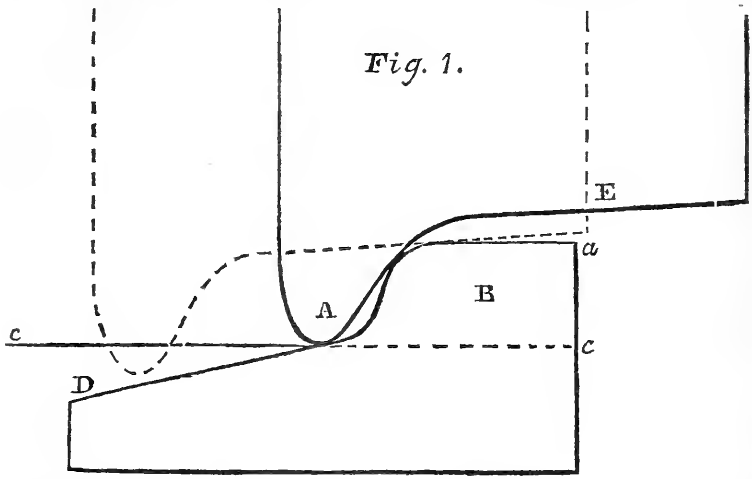
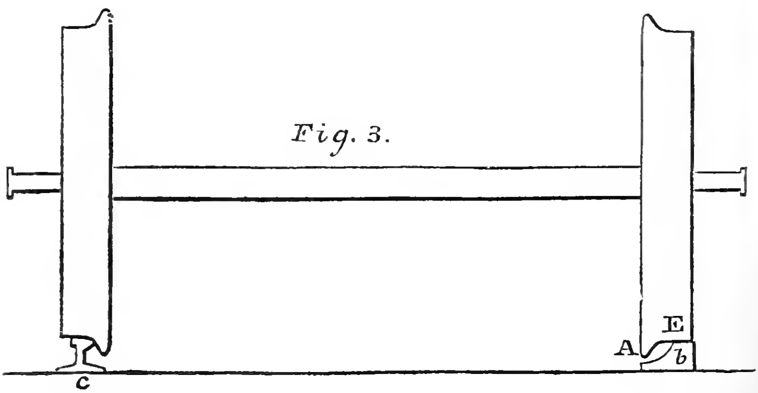


Fig. 2,* is a top view of the two rails, drawn to a reduced size; and fig. 3, a cross section thereof, with the wheels upon the rails.



The height of the flanch of the wheel A, fig. 1, is one inch and a quarter, more or less; and upon the outer rail, I make a projection or rise, B, which is elevated above the horizontal line, *c*, *c*, one inch; the inclined plane being continued from this line to the commencement of the elevation, B. When the flanch, A, of the wheel, approaches the projection, B, it will, in consequence of the inclination which I give to the inner portion, D, of the rail,

* Fig. 2, (a horizontal projection of the curve) referred to in the Specification to the Patent, has been omitted, the demonstration of the principle being perfect without it.

be brought into contact with said inclined part, and have its bearing upon it; this will tend to raise the tread, E, of the wheel, above the upper part, B, of the rail, B, *c*, D, upon which it runs, until the curvature of the rail brings the flanch into contact with the inclined plane, which descends towards D, so that ordinarily the tread, E, bears on the elevation, B. It will manifestly be a consequence of this construction, that when the radius given to the curve is less than that which would enable the flanch of the outer wheel, and the tread of the inner wheel, to roll round equably on the respective rails, the flanch of the outer wheel will be brought into contact with, and will roll round upon, a more elevated part of the inclined plane of the outer rail, whilst the projection, B, will serve as an effective check and guide, should the flanch be brought into actual contact with it. When the radius is greater than this, the wheel, in turning, will run alternately upon its flanch and its tread on the outer rail, and will thus become self-regulating; the distance between the two rails being of course so adjusted as to admit of the necessary play.

In fig. 1, the upper and outer angle, *a*, of the outer rail is left perfect, as this will admit of the paving directly up to, and flush with it, when desired; in the other figures, this corner is shown as rounded off, but neither of these modes of forming the rail affects the principle of construction, or manner of operation; *b*, and *c*, figs. 2, and 3, are end views of the respective rails.

Having thus fully described the nature of my improvement in the construction of rails for enabling cars and carriages to turn with facility upon short curves, what I claim therein as constituting my invention, and desire to secure by letters patent, is the manner of forming the outer rails of such curves with the projection, B, and the inclined plane, D, in such manner, and in such proportion to the flanch and tread of the wheel, and the curvature of the rails, as that they shall co-operate in the manner set forth, in producing the effect herein fully described, the inner rail, in this case, being one of the ordinary kind, and a grooved, or guard, rail not being necessary, or indeed admissible. HENRY M. NAGLEE.

Remarks by the Patentee.—Curves of radii varying from fifty to one hundred and twenty feet, constructed upon the above plan, have been in very successful operation during the last five months at the New York depot in Philadelphia, giving entire satisfaction to the railroad company, and meeting the most sanguine anticipations of the patentee and his friends.

The dotted line represents the wheel, sustained upon its tread, which will be its position when the wheel which is upon the edge rail is running with its flanch in contact with it. Also shown in fig. 3, which is a cross section, with the wheels upon the rails.

Important Improvement in the Manufacture of Counterpanes, or Bed-quilts.

Mr. Erastus B. Bigelow, of Lancaster, Massachusetts, who is the inventor of a power loom for weaving figured goods of various kinds, and of one for weaving coach lace, which is in successful operation, has recently obtained a patent for a power loom for weaving figured counterpanes, which he denominates the *Paisley counterpane.* The goods produced in this loom are of a quality very superior to such as are produced in the hand loom; at all events we have not met with any thing of the kind in the shops that will

compare with them for texture, and for beauty and regularity of pattern We speak advisedly on this point, having two of them in use, that have been examined by persons who are good judges in such matters. Of their durability there cannot be any doubt, and the friends of domestic industry will be glad to learn that the manufacture is so much facilitated by the invention of Mr. Bigelow, as to cause them to be afforded at a price considerably below that at which those of an inferior quality can be imported, and yet to give a satisfactory remuneration to the manufacturer.

They are made of the largest as well as of the smaller sizes; and that we have is about fourteen quarters square.

We shall not here attempt to describe the loom, as this would require a drawing, and would be interesting to manufacturers and machinists only; we speak of these counterpanes now, for the purpose of calling attention to an article which every housekeeper wants, and the cost of which has hitherto stood in the way of their being as generally used as they are now likely to be. We anticipate that at a very early day, American counterpanes will become as general as berths on board steamboats, and as beds at hotels. The articles are for sale in all our large cities, and as soon as there is a sufficient supply, will make their way into every part of the Union.

On the Manufacture of White Lead from the Pulpy Oxide produced by Attrition.

At p. 124 of our last number, after giving the specifications of three patents, in each of which the first step in the manufacturing of white lead was the producing of a pulpy oxide by the friction of fragments of lead in water, we made some remarks tending to show that this process was not of recent origin, and ascribed the invention of it to Joseph Richards, of Philadelphia, who obtained a patent for it on the 28th of May, 1818. We have since turned to some memoranda on this subject, and find that a patent of still earlier date, was obtained by George F. Hagner, of Philadelphia, which patent was granted on the 13th of October, 1817. The manufactory established at Norristown was under Mr. Hagner's patent. The following is an extract of a letter written in answer to an inquiry made by us about two years ago, and which was not at hand when the remarks above alluded to were written. The writer of the letter was not concerned in the manufactory at Norristown, but is perfectly familiar with the different processes which have been followed in obtaining, or attempting to obtain, carbonate of lead.

"The mode used by Mr. Hagner, who is the patentee, was to granulate the lead, casting it, in a melted state, into water; the granulated lead was then placed in a cylinder with a small portion of water, and the cylinder being made to revolve, caused a disintegration of the lead, and a partial decomposition of the water, producing a white lead, which was washed and ground in the usual manner. At first, owing to its fine colour, it obtained purchasers; but it was found that when used it turned yellow in a few days; and I was informed by one person that this change took place in forty-eight hours, when exposed in a warm situation. My supposition was, that this was occasioned by the loss of a portion of carbonic acid, but partially combined with the lead, and the consequent production of a yellow oxide. The sales in this city were very limited; the manufactory continued in operation about two years, and as it was very extensive it must have sunk a large

sum of money." The foregoing account says nothing of the manner in which carbonic acid was supplied to the lead, and would lead to the inference, therefore, that it was obtained from the atmosphere only. It will be proper to remark, however, that the inquiry related principally to the triturating process, and that the letter was not intended to make known the particulars of the manipulation, nor is it supposed that the writer had informed himself on this and other points; besides which many years had elapsed since he had thought upon the subject. We have recently written to a gentleman who is said to have been the conductor of these works, and hope to obtain all the facts of importance relating to them. The destruction of the records of the Patent Office prevents our obtaining a copy of the specification of Mr. Hagner's patent, but if we had this, it would probably throw no more light on the subject than is afforded by that of Mr. Richards, which we have obtained, and is as follows:—

"The discovery consists in the forcible introduction of atmospheric air, by means of a bellows or otherwise, into or through the cylinder, or barrel, in which lead is put for attrition by water, whilst the cylinder or barrel is revolving; or in other words, the application of a current of atmospheric air to lead whilst it is undergoing the process of attrition by water, for the purpose of producing a perfect carbonate of lead within the cylinders.

JOSEPH RICHARDS."

The foregoing process, it will be seen, contemplated the supply of carbonic acid by the introduction of atmospheric air only; whether it was subsequently derived from any other source in Mr. Hagner's establishment, we shall probably learn at an early day, and if so, we shall publish the fact. There must be among our readers some persons well informed in this matter, and we earnestly request that they will take the trouble to communicate what they know of the case to us, or to the Actuary of the Institute.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a patent granted to CHARLES HULLMANDEL, *of the city of Westminster, lithographic printer, for his invention of a new mode of preparing certain surfaces for being corroded with acids, in order to produce patterns and designs for the purpose of certain kinds of printing and transparencies.*—[Sealed 26th March, 1838.]

My invention consists, first, in drawing narrow or broad lines, so as to produce figures or patterns directly on the surfaces of copper or steel, or other metallic or glass plates, or rollers, and without the previous intervention of any resinous or other ground or covering, with a composition or mixture soluble in water, and which mixture, when the plate has been subsequently covered with varnish and steeped in water, will dissolve and rub off with the varnish which is over it, thus exposing the surfaces which were under the mixture to the action of any acid which may be used to corrode the same; and secondly, in the application of grease to such surfaces as aforesaid, for the purpose of obtaining a reticulated or irregularly exposed portion of the same for the action of such acids as aforesaid, for the purpose of producing shaded figures or patterns, as hereinafter explained.

A sheet of parchment marked A, with a number of specimens, figures, and patterns, accompanies the specification by way of illustration. It must, however, be evident, that from the nature of the specimens it would be impossible to give any correct graphic representation of them here; but, in order that our readers may have all the information we are enabled to furnish, we publish the specification verbatim, with all the references to the sheet of specimens registered in the Court of Chancery.

Description of the new method.—First, I mix seven parts of a thick solution of gum arabic (say about the thickness of cream) with about one part of treacle and a small quantity of the best lamp black to give it a colour, and grind them well together; or to speak more accurately, take of treacle nine grains; gum arabic in powder eighteen grains; best lamp black nine grains; mix with water to the consistency of cream, and grind well. The object of the treacle is to hinder the gum from chipping off, which it would otherwise be apt to do from the surface of the metal or glass. With this colour and a camel's hair pencil, I draw on the naked surface of the metal or glass, whatever subject, figure, or pattern, is intended, a sketch or tracing of the same having been previously transferred to the surface of the metal or glass by the usual means of tracing paper or otherwise; if, however, straight lines only are required to be produced, the common mathematical pen and a rule, or a common quill or steel pen may be used, according to the nature of the subject. The specimens Nos. 1, 2, 3, and 4, in sheet A, represent the sort of patterns or figures that may be so drawn as aforesaid. No. 1, being drawn with a camel's hair pencil or brush, and Nos. 2, and 3, with both a common quill and mathematical steel pen; No. 4, being drawn with both a camel's hair brush and mathematical pen.

The pattern or design being thus completed in outline, a varnish must either be poured on the plate or else spread on with a flat brush, so as to lay perfectly even on the surface. If the pattern or design has been executed on a cylinder or roller, an axis or spindle must be fitted to the roller, and the whole fixed on to a stand, so as to turn by means of a handle or otherwise, and the varnish being laid on with a flat brush over the whole surface of the roller or cylinder, it should be turned round on its axis with a slow and even motion, until the varnish has spread evenly over its whole surface and is set. I lay no claim to any peculiar varnish; but I prefer for this part of the process, a mixture of four or five parts of what is called in Paris, "petit vernis," and one part of what is commonly sold in London, under the name of Brunswick black; the surfaces of the metal or glass with the designs upon them being thus coated, the varnish must be allowed to dry for twenty-four hours, when the plate or cylinder, as the case may be, must be steeped in water for two or three hours, and afterwards by gently rubbing the surface with a soft hair pencil or a sponge, the varnish will leave the metal wherever the mixture above-mentioned of gum and lamp black has been previously applied, as well as the said mixture itself; and that part of the surface, which is intended to produce the pattern or design, will be left completely uncovered, and prepared for being bitten or corroded to the depth required, by such acid as is usually employed for biting or corroding, according as metal or glass has been used, in which latter case, fluoric will of course be the proper acid. The parts thus exposed as aforesaid, having been sufficiently corroded or bitten, the varnish must be removed with spirits of turpentine in the usual manner, and the surface well cleaned.

The second part of my said invention is, the preparing the said surface for biting in the shadows for the pattern or design, obtained in outline, as be-

fore described. For this purpose I take a very small quantity of tallow, or grease of any kind, on a rag or piece of wash leather on the tip of the finger, and rub the surface of the plate or roller with it, so as to grease it all over slightly, though perceptibly; this done, the said surface must be rubbed with a dry soft cloth or rag, and this operation of rubbing with a rag must be repeated two or three times, until the surface of the metal appears to be well wiped, and no visible grease left, though, in fact, there must be a greasy coating over the whole surface.

A mixture of a solution of equal parts of gum arabic and gum tragacanth must then be prepared, to which solution, treacle must be added in the proportion of one part of treacle to five parts of the solution, and the whole well ground with a small quantity of good lamp black or any other coloring material, merely to give it a colour; or to speak more correctly, take of powdered gum arabic, twelve grains; powdered gum tragacanth, seven grains; put these in solution in a little water for two days, and then add treacle, nine grains; best lamp black, ten grains; and grind all well together. On applying some of this coloured solution with a camel's hair pencil to the surface prepared with grease as aforesaid, the solution will retract or withdraw itself into reticulated or irregular forms, or a sort of net work, as exhibited in specimen No. 5, which shews the effect produced by merely dabbing or drawing a brush containing the mixture over the prepared greasy surface of the plate, by which means, if laid on in an artist-like manner, forms and shading can be produced with the greatest ease and rapidity, as shewn by the specimen or shaded pattern specimen No. 6, which is the same specimen figure of No. 1, with the shading added thereto. Specimens 7, 8, and 9, also shew the effect produced by the novel kind of shading in different figures or designs. Specimen No. 10, shews the same effect of shading, the design or pattern being on a dark ground, produced by dipping a small piece of soft sponge in the ink or mixture, and dabbing it upon the prepared greasy surface; or the same effect may be produced by a dabber, commonly used by engravers in laying on etching ground, the dabber being covered with soft wash leather, and dipped in the ink, and applied to the surface of the metal, plate, or cylinder. The closeness or openness of this network or shading can be modified by using the colour thicker or thinner.

By this second method of preparing the surface, it is evident that original figures, patterns, or designs, may be executed, or else it may be used to produce shadings to the patterns previously designed or corroded by the first-mentioned process. In the case of designs and patterns for printing on silk, cotton or woolen fabrics, these may be either wholly produced by one or other, or both of the methods before given, or part of the patterns or designs may be executed by the methods already in use, and the shading produced by the second part of my said invention herein before described. The design or pattern being completed by shading as aforesaid, the varnish is laid on as already explained, for the first part of my said invention, and the parts which are intended to be corroded or bitten, uncovered by again steeping the plates or rollers in water, and gently rubbing as before mentioned.

When the pattern is small and often repeated, as shewn in specimens Nos. 11, 12, and 13, it can be executed in wood in the ordinary manner of block printing, or in metal; and by charging the pattern thus carved or engraved with the aforesaid gum and lamp black, and fine sand, which are to be mixed in about the following proportions:—gum arabic in powder, forty grains;

best lamp black, six grains; very fine sifted sand, fifty grains; or else gum arabic, forty grains; lamp black, six grains; powdered pumice stone, sixty grains: this ink must be very slightly ground. In the first recipe the lamp black and gum in solution must be ground together, and the sand added afterwards. The plates or blocks being charged with the mixture in the same way that a wood block or engraving is charged for printing on calico or paper, the small design may be repeated on the naked surface of the metal or glass as often as is required, the whole being then covered with varnish, afterwards soaked in water, and corroded with acid as before described.

Now, whereas, it is evident, that patterns and designs may be produced by the use of either the first or second part of my said invention, as well as by both combined, and that clean, even black lines, may be produced on the greased surface by the addition of a little gall to the gum solution, as well as on the bare surface of the metal or glass, the Nos. 11, 12, and 13, being specimens of the several styles.

And whereas, I do not claim as my invention the use of any peculiar varnish, or of any peculiar solution or colouring matter for the purpose aforesaid; but I do claim, first, the application of these materials, mixed in manner aforesaid, directly on the bare surface of metal or glass plates or rollers, as herein before explained, with reference to the first part of my invention; and then varnishing and steeping the said plates or rollers in water, and rubbing off part of the said materials as aforesaid, and thus preparing the said surfaces, to be corroded or bitten with acid, so as to produce patterns and designs as aforesaid, for the purposes aforesaid.

And secondly, I claim the preparing of surfaces of metal or glass by greasing them as herein before described, so as to produce a sort of net work, or irregular marks, shading patterns, or designs, for the purpose aforesaid, when drawn upon in manner aforesaid, and afterwards varnished, steeped and rubbed, as explained in the second part of my said invention.

Lond. Jour. Arts & Sc.

Specification of a patent granted to William Neall Clay, *of West Bromwick, in the county of Stafford, manufacturing Chemist, for his invention of improvements in the manufacture of iron.*—[Sealed 19th December, 1837.]

There may be said to be three classes of iron ore:—First, the common argillaceous iron stone, generally used in the manufacture of iron in Great Britain; secondly, the rich carbonates of iron, containing little earthy matters, which, when roasted, part with their carbonic acid, and absorbing oxygen, become, (after roasting,) oxides of iron; thirdly, native oxides of iron, either pure or combined with silica, and in very small quantities, other earthy matters; and according to the ordinary means now pursued, from making iron from iron ores, it is well known that that description called argillaceous ores, are commonly employed; such for instance, as are found in the coal fields of Staffordshire, Wales, Scotland, and in other places; and in making iron from such ores, they are in the first instance submitted to the process of roasting, and the iron stone or ore thus treated, is called "burnt mine," "roasted mine," or "roasted ore;" such *burnt mine*, *roasted mine*, or *roasted ore*, with suitable fuel and fluxes, is then submitted to the process of smelting, in large blast furnaces, and run therefrom into what are

called pigs, or in some cases directly used for iron casting. In case such pigs are to be converted into malleable iron, they are submitted to the processes of the refinery and puddling furnaces, all which is well known and in extensive practice in this country; and in some instances, iron masters have recourse to the mixture of certain portions of the red and other rich iron ores of Cumberland, Lancashire, North Staffordshire, and other places, with the roasted argillaceous iron ores above mentioned, in order to enrich those poorer ores. But such is the peculiar property of the rich iron ores referred to, under the heads secondly and thirdly, that they are not capable of being manufactured into iron by the process above stated, when used alone, although I believe that some of the rich Lancashire ores are for particular purposes, and mixed with a small portion of poor ore, at considerable cost, reduced by means of charcoal in blast furnaces.

Now it is well known that the red and other rich ores, above mentioned, contain much more iron in a given quantity of ore, than the argillaceous ores, mainly employed; and the veins of such ore are in many places in great thickness; but up to this present time, the ores under the heads secondly and thirdly, have not by themselves been brought into practical working, but have only been partially used, combined with poorer ores, in the manufacture of iron.

Now the first object of my invention relates to a mode of working such rich ores, and producing malleable iron therefrom by a very simple process and at a very small cost compared with processes now employed for making iron from argillaceous iron stone or iron ore.

I will now proceed to describe the process I have pursued and found to answer, and which in combination with the converting of the richer ores, on a practical scale, constitute my invention.

I take any quantity of the red Lancashire or Cumberland ore, or other ores of a rich character, and break the larger lumps by means of a pair of rollers or otherwise, to about the size of walnuts, which I believe to be the best size for working;—with one hundred parts, by weight, of such broken ore, I mix twenty parts of clean dry coal ashes or cinders, or of coke, charcoal, charred peat, anthracite coal, or other suitable carbonaceous matter, broken so as to pass through a sieve of half an inch mesh. This mixture is to be put into retorts or vessels, which I prefer to be of a ⌓ shape, about seven feet long and eighteen inches high, and two feet wide, made of clay, fire brick, iron, or other suitable material, capable of sustaining bright red heat by daylight. These retorts I prefer to be fixed horizontally, in a chamber which may be constructed at the end of a puddling or other furnace, so that the otherwise waste heat of the furnace may be employed for heating such retorts and their contents, to a bright red heat, at which degree of heat the contents should be kept some time.

The chamber for the retorts is built suitable for containing several retorts (according as the puddling furnace is capable of supporting the requisite degree of heat,) between the end of the puddling furnace and the chimney, leaving a sufficient space, so as not to impair the draught of the puddling furnace; and I prefer that the ends of the retorts should be so much above the ground, that there may be an iron barrow run alongside, to receive the charges of the retorts as they are discharged.

By this arrangement the flames and heated vapours passing from the puddling furnace, heat the retorts or vessels on the exterior, without having access to the iron ore in the retorts. One end of each of the retorts is stopped with a door in a similar manner to that adopted in retorts for dis-

tilling coal for gas, so that they may be readily opened to discharge, and may be immediately charged and again closed, for it is desirable to be constantly working, so long as there is sufficient heat, and the retorts and furnace are in proper repair,—the capability for which constant succession of charging and discharging, is an important feature of utility in my process, for it does not require that the retorts should ever be cooled down, but, as above explained, so soon as one charge has undergone the process and is discharged, a fresh charge is to be put into the retort, and there are to be pipes connected with the retorts, to carry off the vapours evolved in the process, similarly to gas retorts, in making coal gas, which may be conveyed to the chimney or elsewhere.

In charging these retorts, I fill them with the mixture of iron ore, and cinder, coke or coal, above described, until it reaches to the boundary line of the flues which heat the retorts; I then add two or three shovels full of cinder, coke, &c., and close the door, so as to prevent the ingress of any atmospheric air. In this condition, the retorts are to remain for twelve hours or upwards, the duration depending on the degree of heat applied; but the completeness of the process may, at any time, be ascertained by taking out some of the pieces of ore from the retorts, by means of tongs, and with a file filing the surface of such ore to ascertain whether it has arrived at the metallic state; a very little practice will suffice to enable the workman to judge accurately of the process.

The charge on being drawn from the retorts may (when the product is to be made into malleable iron,) be immediately conveyed into a puddling or balling furnace, and if the product appears not to be generally in a metallic state, five per cent. or more, of small anthracite coal or other carbon, is to be put into the puddling furnace with it. The prepared iron or product from the retorts is to be balled in a furnace of the customary description, as if treating "refined iron" of the ordinary process of manufacture, and it will "come to nature" very readily, and may be said to be a welding of the many parts into balls rather than puddling; and after the cinder is well worked out it may be balled or looped, (or by whatever other name the process is called,) and taken to the hammer, or rolled according to the will of the operator.

I have here described the retorts as being set in a chamber applied to a puddling furnace, in order to use the otherwise waste heat at the same time. I do not confine myself thereto, as a chamber with retorts may be heated by other furnaces, and although I have mentioned twenty parts of cinder, coke, charcoal, anthracite coal, or other suitable carbonaceous matter to one hundred parts of ore, I do not confine myself thereto,—the object is to have sufficient. I have found, that a larger quantity than is really necessary for the process, at the degree of heat above mentioned, is not prejudicial, but it has fully effected the object of my invention.

And I would further remark, that although I have mentioned particular sized and shaped retorts, and their being set in a horizontal position, I do not confine myself thereto, as the same may be varied, provided the character of my invention, as above explained, is otherwise retained; and although I prefer the using of retorts, such as are herein described, having the requisite heat applied to the external surface thereof, I do not confine myself thereto, as large masses of iron ore may be heated, according to my invention, and a furnace similar to a conical lime kiln, may be employed, in pursuing this mode of carrying out my invention.

I place a mixture of one hundred parts of ore with sixty parts of coal,

coke, or other suitable carbonaceous matters, or thereabouts, in the kiln, and having fired and raised the kiln to a very bright red heat, as equally as possible, I then prevent all further ingress of atmospheric air at the lower part of the kiln, by stopping up the apertures;—having thus stopped all admission of air from below, I put five or six inches of anthracite coal, coke, or other suitable carbonaceous matter, on the surface; by this mode of treatment, the fuel in the ignited kiln, being deprived of all further supply of atmospheric air, will so act upon the iron ore as to reduce it into the metallic state,—and the progress of such working may be ascertained by taking out portions, from time to time, as explained in respect to the retorts; and when it is judged that the iron ore has become deoxydized, the charge may be drawn, and a fresh one immediately supplied to the kiln or furnace.

I would, in conclusion, further state, that when it is desired to make cast iron, according to my invention, I charge the retorts with thirty parts, by weight, of the carbonaceous matter or matters, above named, to one hundred parts of the rich iron ore, and continue the application of heat for a longer time, say for half as long again, than for simply reducing the iron to a metallic state,—for in order to make cast iron, it is necessary to impregnate it with carbon to that extent, that it will readily melt when taken to the cupola furnace of an iron founder, who may then use it as he would the broken pig iron of the old process.

I would remark, that I am aware it was several years back proposed to melt such rich iron ores in pots or crucibles, with charcoal or other carbon, in order to produce steel by such process;—I do not therefore claim any process of retorts or vessels, or kilns for treating such rich ores with carbon, where smelting is performed; and I am aware that as a chemical fact, it is known that iron may be obtained by cementation, from burnt argillaceous ore,—and further, it has been proposed to submit "burnt mine," "roast mine," or "roast ore," in a practical form, according to a system of tests, to the well known process of cementation, like that pursued in converting iron into steel in closely cemented vessels, such process of tests requiring the heat to be gradually raised to the proper high degree of temperature, then retaining the same to that heat for many hours; and then gradually cooling down the same before drawing the charge, by which it was proposed to produce steel and iron from roasted mine, such process being the subject of a patent, in the name of John Isaac Hawkins, dated the fourth day of July, one thousand eight hundred and thirty-six; but such process of test and cementation, would probably be at much greater cost than reducing the like roast mine, or ore, by the ordinary blast furnace, which, as is well known, is the usual mode of making iron from like materials; and I have mentioned the processes, to state, that I lay no claim thereto; for my invention relates only to the working of the richer ores, and such as are not reducible by the ordinary means of blast furnace; and does not relate to the roasted argillaceous ores, commonly employed in the manufacture of iron; and moreover, it is not necessary previously to roast such rich ores, as I have above mentioned; and it would be only an unnecessary expense so to treat such ores.

Ibid.

Specification of a Patent granted to Charles Adolphe Roederer, *of Strasburg, but at present residing in the City of London, for an Improved Method or process of Manufacturing or Preparing the Chemical Salts called Acetates.*—Sealed April 9, 1839.

The various processes which have hitherto been employed for the formation of acetates, and in particular the acetate or sugar of lead, consisted in mixing the base with liquid acetic acid, either in a concentrated or weak state. But this mode of operating is productive of many serious disadvantages, amongst which may be mentioned, the expense of fuel, of apparatus, of labour, and of time, the loss of acid, and the difficulty of producing acetates capable of perfect crystalization and of pure quality. Most of these disadvantages are obviated, and the remainder considerably moderated by my improved process, which consists in employing the acid in the state of vapour, to act upon the bases, instead of using it in the liquid form. I provide a vessel of adequate capacity for the quantity of acetate I wish to make at once, and constructed of such materials as will not readily be destroyed by the acid. The top of this vessel I close hermetically by a cover, fastened down by any convenient means; and in the lower part of the vessel I place either a minutely perforated false bottom, or a coiled tube of several convolutions, minutely perforated, to permit vapour to pass through freely. To prevent the loss of acid I also place, at different degrees of elevation, several perforated diaphragms, similar to the false bottom just mentioned, on each of which I spread a layer of litharge (if I am making acetate or sugar of lead, or a layer of other proper base, according to the acetate required;) after which the cover of the vessel is to be accurately closed. By means of an ordinary distillatory apparatus, I convert liquid acetic acid (strong or weak, pure or impure) into vapour, which vapour I conduct by means of a pipe, into the convoluted perforated pipe before mentioned, or between the real bottom of the vessel and the perforated false bottom; hence the vapour passing through the numerous perforations of the false bottom and diaphragms, diffuses itself throughout every part of the vessel, its acid entering into combination with the base employed, and forming the acetate which falls to the bottom of the vessel, and in its descent meets with the ascending streams of vapour, the acid of which renders it perfectly neuter; meanwhile the more aqueous parts of the vapour becoming liberated, and maintaining their temperature, ascend, and in their passage through the successive layers of the base are thereby deprived of their remaining acid. The vapour thus reduced to simple steam, is allowed to escape through one or more pipes at the top of the vessel, and as this steam still maintains a boiling temperature, I conduct it through a worm to evaporate the acetates or the mother liquor by its heat. The distillation of the acid is continued, until the acetate in the vessel is arrived at the proper degree of concentration for crystalization, which is easily ascertained, by examining a small quantity drawn off by a cock at the bottom of the vessel, by which cock the whole contents are discharged when the operation is completed.

As the operation draws to its close, by nearly all the base having combined with the acid, the vapour issues out of the vessel charged with a certain portion of acid, and in order that no loss may be sustained by its escape into the atmosphere, it is conducted into another vessel prepared like the first mentioned, but charged superabundantly with the base, to take up ev-

ery particle of the acid issuing out of the first vessel, until the operation in the first vessel is ended.

The great saving of fuel effected by my process is evident from these circumstances, that my operation finishes where the ordinary one begins, and that the mother liquor is evaporated by the latent heat of the aqueous vapour, before it is discharged. The apparatus is extremely simple and cheap, being also self-acting, much labour is avoided by it; and finally as the temperature of the solution or the acetate can never exceed that of the vapour, the crystaline product is of finer quality than ordinary.

Rep. Pat. Inv.

Specification of the Patent granted to WILLIAM WIESMANN, *of the City of London, for Improvements in the Manufacture of Alum.*—Sealed November 16, 1839.

My invention relates to a mode of manufacturing alum, by which the same may be produced free of iron and alkali, (or nearly so.) And in order to give the best information in my power, I will proceed to describe the process pursued by me. I take potters' clay, as free from iron as possible, and calcine the same to a moderate red heat, in order, as much as possible, to drive off all humidity. The clay so calcined is next to be ground to a powder, and to be placed in leaden pans heated by a moderate fire, or by steam, and sulphuric acid (about 66° by Beaumé) is to be applied in sufficient quantities, that the acid may dissolve nearly the whole of the clay. I prefer that the whole should not be dissolved, as a saving of acid is thereby obtained. The mass in the pan is to be stirred until it is dry, when boiling water is to be applied to dissolve the salt formed, and water is to be so applied till the whole of the salt is separated; the liquids thus obtained, are mixed and placed in vats, and left therein till perfectly clear. A measured quantity of the liquor is to be tested with prussiate of potash, or other suitable material, to ascertain the quantity of iron contained in such measured quantity of the liquor, then the whole quantity of liquor being known, the quantity of iron therein may be obtained by calculation, and whatever be the weight of iron the liquor to be operated on is found to contain, an equal weight of prussiate of potash, dissolved in water, is to be stirred into the liquor, which will take to the iron, and they together will be precipitated; by this means, the liquor drawn off clear or filtered, will be composed of sulphuric acid, alumina, and water, and in this condition, may be used for the purpose of the arts; but when required to be crystalized, I reduce the liquor by quickly boiling and strong evaporation, and evaporate it in large leaden vessels until a skin of salt forms on the surface, when the liquor is drawn into shapes, where it cools and crystalizes. I would here remark, that I am aware that clay treated with sulphuric acid, has been employed in the process of making alum, but the processes have been conducted in a different manner, requiring much time, and producing alum not so pure and concentrated. I do not, therefore, claim the same generally, when practiced according to the means heretofore known. And, although I prefer the employment of prussiate of potash for precipitating the iron, I do not confine myself thereto, as other materials may be used, such as the lixivium of blood, or sulphate of lime. But what I claim is the mode of making alum from clay, as herein described, whereby the alum will contain as much more alumine, and is free or nearly free from iron.

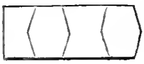
Ibid.

Specification of a Patent granted to Robert Carey, *of the county of Kent, gentleman, for certain Improvements in paving or covering streets, roads, or other ways.*—[Sealed 29th January, 1839.]

This invention is for using wooden or stone blocks of a particular shape, so that they may be enabled to support one another. The shape used by the patentee, is represented at fig. 1, which is a side view or elevation of three or four blocks, put together in the same way as they would be on a roadway. Fig. 2, is a plan view of fig. 1.

It will be seen that each separate block both supports and is supported by all those with which it is in contact, so that upon a weight being placed upon any particular block, the four surrounding blocks each assist in supporting the same, as, indeed, do all the other blocks for a considerable distance round, because it is impossible for any block to sink without carrying down four others with it; and these others are, in their turns, supported by such other blocks as they may be in contact with. It will, therefore, be evident, that the strength necessary to support any weight, will be obtained from all the surrounding blocks.

Fig. 1.



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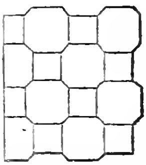


The claim of invention is constructing blocks of wood, which, when placed together and accurately fitted, shall alternately present a concave and convex form, as seen in the drawing, and thereby tending to support each other.

This appears to us to be the best description of wood paving yet offered to the public, and would be the most likely to meet with encouragement, if any economical method could be devised for cutting or forming the blocks with correctness.

Lond. Jour. Arts & Sci.

Specification of a Patent granted to James Stevenson, *of Leith, and* John Ruthven, *of Edinburgh, for their invention of a method of cutting wood by certain improved instruments.*—[Sealed 28th April, 1835.]

Instead of employing circular or longitudinal saws, of the ordinary construction, for the purpose of cutting wood, the patentees have invented an improved instrument, which consists of a circular disk of steel or iron, having sockets formed round its periphery for the purpose of receiving the cutting tools, which are thin pieces of steel similar to chisels, and ground to a fine edge. Upon rotary motion being communicated to this circular disk of iron, the chisels, which are fixed in the sockets, cut the wood away without wasting any in saw-dust, as is the case with common circular saws. These small tools or chisels may be adapted to a longitudinal piece of thin iron, so as to form a long saw, if required.

The claim of invention is for using tools of the above description for cutting wood, in the place of the teeth of a common saw.

Lond. Jour. Arts & Sci.

Specification of a Patent granted to Joseph Skinner, *of the city of London, civil engineer, for his invention of certain improvements in machinery for cutting wood, for veneers and other purposes.*—[Sealed 29th December, 1835.]

The wood is cut by a stationary, longitudinal knife, against which the block of timber is pressed by what the patentee calls a compressing edge or roller, and the thickness of the veneer is regulated by two upright

screws, which cause the block to descend to the amount of the required thickness of the veneer, after the knife has cut off one thickness.

Ibid.

Specification of a patent granted to Harrison Gray Dyar, *and* John Hemming, *both in the county of Middlesex, for their invention of improvements in the manufacture of carbonate of soda.*—[Sealed 30th June, 1838.]

The nature of our invention consists in the use of carbonate of ammonia (that is, the sesqui-carbonate or bicarbonate,) in the manufacture of carbonate of soda, by applying it to decompose common salt, and also in afterwards restoring or recovering the ammonia which has been so used, or the greater part thereof, in such a way as to allow of its being used again to convert other portions of common salt into carbonate of soda, thus repeatedly producing successive portions of carbonate of soda from the same portion of ammonia. To render the description of our process more intelligible, we divide it into two parts. The first part being the description of our method of using the sesqui-carbonate or bicarbonate of ammonia in the manufacture of carbonate of soda. The second part being the description of our method of restoring or recovering the ammonia, or the greater part thereof, in such a way as to be again employed in converting other portions of common salt into carbonate of soda.

As to the first part:—The carbonate of ammonia of commerce is what the chemists call the sesqui-carbonate, and in describing our process, we shall use the term carbonate of ammonia, as denoting the sesqui-carbonate. The bicarbonate is not generally met with, but is to be preferred when it can be obtained; and, accordingly, in reproducing the ammonia, we recommend the process to be carried on in such a manner as to produce as much of the bicarbonate as possible. We take nearly equal quantities by weight of common salt, otherwise called chloride of sodium or muriate of soda, and of carbonate of ammonia. We dissolve the common salt in as much water as is barely sufficient to dissolve it, so as to constitute a fully saturated solution, and when so dissolved, we add to it the carbonate of ammonia in the solid form, but bruised or pounded to a state of fine powder. We prefer that the common salt should be the substance dissolved, and to add to it the said carbonate of ammonia in a pulverized state; but the result may be obtained by dissolving the ammonia, and adding the common salt in a state of powder: but according to our experience this is not quite so well. We mix these well together, and suffer them to remain thus mixed from ten to twenty hours, stirring or agitating them from time to time, to prevent the solid parts from settling before the chemical action is sufficiently complete. We then drain or filter the liquid from the solid matter, and in order to separate as perfectly as is convenient all the liquid from the solid matter, we press the substance in an ordinary hydraulic or screw press, or submit it to considerable pressure by any other convenient mode. The solid matter thus obtained is chiefly a carbonate of soda, containing, however, more carbonic acid than is found in soda ash, or crystals of carbonate of soda, of commerce. To remove this excess of carbonic acid, and to recover any ammonia contained in the carbonate of soda, we next place the solid matter so obtained, as aforesaid, in a retort or other convenient vessel, and heat it from about six hundred degrees to eight hundred degrees Fahrenheit, until all the liquid and volatile matter contained in it is drawn off by that heat. The substance left in the retort is the carbonate of soda.

We pass the matter thus volatilized into a cool chamber or refrigerating apparatus; an example of which is furnished by the lead balloons used in the condensation of carbonate of ammonia, in the usual manner, wherein the carbonate of ammonia becomes condensed; but any convenient mode of condensing ammonia may be adopted.

As to the second part:—the liquid separated from the solid matter, that is to say, from the solid carbonate of soda by the pressure in the operations described in the first part of this specification, or by filtration, contains in solution muriate and carbonate of ammonia, common salt, and probably also a small portion of the carbonate of soda formed. In order, therefore, to separate the carbonate of ammonia therefrom, we place it in a distilling vessel, and distil over the water and the carbonate of ammonia, and receive the product in a cask or proper vessel which we keep filled with carbonic acid, obtained from any economic source, in order to prevent loss of ammonia; or instead of distilling over, as above described, the water and the carbonate of ammonia, we add to the liquid a solution of muriate of lime, or chloride of calcium, which is one of the results of our process, until a precipitate, which is chiefly carbonate of lime, ceases to fall. We separate this precipitated carbonate of lime by filtration or other means from the liquid, which is then chiefly a solution of muriate of ammonia and common salt. We evaporate this by heat to a sufficient consistency, to enable us to separate the common salt (in cases where it is desirable to do so on account of the value of common salt,) which being less soluble in hot or boiling water than muriate of ammonia, crystalizes first, and may be separated by well-known means. When the common salt is removed from the liquor (if desirable, or without that process if not thought worth while,) we evaporate by gentle heat the muriate of ammonia to dryness, and mix it intimately with a sufficient quantity of pounded chalk, and heat the mixture in an iron retort or other proper vessel, until the carbonate of ammonia, formed by this operation, is sublimed and separated in the usual way. We receive this carbonate of ammonia in a chamber or vessel formed of lead or other suitable material, where it becomes condensed; and we make a communication by means of a pipe between this chamber or vessel, and another chamber or chambers. Into one or more of these chambers we cause the carbonic acid and other volatile matters to pass, which were expelled by heat from the carbonate of soda, formed, as before described, in the first part of this specification. We receive the carbonic acid into one or more of these chambers, for the purpose of preventing loss of ammonia, by converting free ammonia into carbonate of ammonia, or bicarbonate of ammonia; and if the carbonic acid from the soda is not sufficient for this end, we pass more into them, which we obtain from coal, coke, charcoal, or any other economic source, as well as a sufficient quantity of water, or vapour of water, to condense and save the ammonia. Or in order effectually to prevent the loss of ammonia, we pass into the last of the vessels or chambers we employ to receive or condense the carbonate of ammonia, a sufficient quantity of muriatic acid gas, obtained by adding sulphuric acid to common salt, or from any other economic source. The muriatic acid gas combining readily with the free ammonia, or the carbonate of ammonia in vapour, forms muriate of ammonia, and thus precipitates in the chamber; by which operation we avoid any loss of ammonia that might otherwise ensue. The muriate of ammonia thus obtained we treat in the same manner as the muriate of ammonia separated from the liquids before described, so that this muriate of ammonia may be converted into carbonate of ammonia or bicarbonate. The carbonate of ammonia obtained or reproduced or

recovered from distilling the muriate of ammonia with chalk, as hereinbefore described, as well as that obtained by the distillation of the liquid, as also hereinbefore described, or by any of the other modes hereinbefore described, we employ over again, to convert other portions of common salt into carbonate of soda, according to the plan detailed in the first part of this specification. The common salt separated from the muriate of ammonia, as before described, we again employ with other portions of common salt in subsequent operations. The residue found in the retorts after the sublimation of the carbonate of ammonia, is chiefly muriate of lime, or chloride of calcium, which may be used as before mentioned. In all the operations we have described for the manufacture of carbonate of soda, we employ vessels or apparatus of such construction as to expose the carbonate of ammonia employed as little as possible to the air, so that loss of ammonia may be prevented.

We do not claim as our invention, any particular form of vessel or apparatus in which our operations are conducted, nor any of the chemical substances above mentioned as such; but we claim as our invention or improvements, the use of carbonate or bicarbonate of ammonia in converting common salt into a carbonate of soda, as hereinbefore described; and as this mode would be too expensive to be profitable, if we could not recover the ammonia used for this purpose, so as to make it available for repeated operations, we claim in combination with the former part of the process, as hereinbefore described, the recovering the ammonia which would otherwise be wasted.

Lond. Jour. Arts & Sci.

Progress of Practical and Theoretical Mechanics and Chemistry.

Transfers from Copperplate to Zinc or Stone.

The Silver Isis medal and five pounds were voted to Mr. R. Redman, for his Method of making Transfers from Copperplate Printing to Zinc or Stone.

The object aimed at by Mr. Redman is to make a transfer of copperplate engraving to zinc, retaining, at the same time, the whole, or nearly the whole, of its original sharpness and distinctness. The same process may be applied to making a transfer from stone to stone or zinc, and thus obtaining two or more plates of the same subject; which has been found to be a great advantage when a great number of impressions are required, or a smaller number in a shorter time than can be taken off from a single plate or stone.

The first part of the process consists in taking an impression from the copperplate in the usual way, but with a peculiar ink, on transfer paper peculiarly prepared.

The composition of this ink, which he calls chemical ink, is as follows:

3 oz. of shell lac;
1 — mastich;
$1\frac{1}{2}$ — yellow bees' wax;
$\frac{1}{2}$ — tallow;
4 — hard curd soap, and lamp-black enough to colour it.

The above ingredients are to be mixed together most intimately, and are then to be burnt in a pipkin for ten minutes, stirring the mass carefully all the time. The residue by exposure to the air becomes damp; so that by pounding it in a mortar it concretes into a paste of a very stiff consistence, and in this state is called, by Mr. Redman, *hard ink.*

One part of this hard ink, rubbed and ground with two parts of common

stiff lithographic ink, forms the transfer ink; which being applied to the surface of an engraved copperplate in the usual way, gives an accurate impression to prepared transfer paper.

This latter is prepared as follows:

One quarter of a pound of the best flour is to be mixed with common porter, in such proportion that it shall form, by boiling, a thin paste of a perfectly uniform consistence; which paste is to be laid quite evenly on the smooth surface of a sheet of india paper, and is to be dried gradually.

The impression being obtained on this prepared paper, it is to be transferred in the usual way to a smooth plate of zinc. When the zinc has received the transferred impression, it is to be covered with an infusion of nut-galls, in the proportion of one ounce of galls to half a pint of water, the mixture to be then simmered for ten minutes in any vessel not of iron. The liquor is to be left on the plate for from five to ten minutes, its effect being to neutralise the alkali of the transfer ink, and thus to harden it and prevent it from spreading when sponged with water previous to printing from it.

Specimens of the ink, and of maps and other subjects transferred by Mr. Redman's process, were laid before the Society. Mr. Webb, lithographer, appeared personally before the committee, and stated that impressions transferred by the usual process to zinc plate come off far sharper and better than from stone. He finds no difficulty in using Mr. Redman's ink, for taking transfer impressions from copper. When a zinc plate is laid by, after use, he sponges it over with the infusion of nut-galls, which protects it from oxidation by covering it with a brown film. On trying other inks, in transferring to stone, they sometimes fail—Mr. Redman's never does.

Trans. Sci. Arts.

New Test Liquor for Acids and Alkalies.

The thanks of the Society were voted to Mr. J. Marsh, for his Test Liquor for Acids and Alkalies, prepared from the Petals of the Red Dahlia.

The infusion of the common red cabbage has been long in use in the chemical laboratory, as a test to distinguish acid from alkaline bodies when in solution; and, although possessed of great delicacy in this respect, is still subject to an objection, on account of its becoming so exceedingly offensive in its smell, after having been prepared a few months.

In order to obviate this objection, I undertook some experiments, about two years ago, on the colouring matter of the dark red hollyhock, the purple raddish, and the dark red beetroot; but, during my experiments, I found many objections to all. The beautiful blue colour of the dark red hollyhock, obtained by alcohol, is, however, worthy of notice; but I have not had time to look much to it during my experiments on this subject, my attention being forcibly drawn to the beautifully coloured infusion obtained from the dark varieties of the dahlia, such as the Conqueror of Sussex, Sir Ed. Codrington, Sir E. Sugden, Alman's Splendissima, Parson's Rival, Brown's Ion, Holmes's Rival, Sussex Lima, Metropolitan Perfection, Pasha of Egypt, Robert le Diable, and Sambo,—these being the varieties that I have mostly employed; there are many more equally as good, but they have not yet fallen in my way.

This infusion is easily obtained as follows:—Into an infusion pot, or any common earthen vessel, let as many of the petals of the above-named dah-

lias be lightly pressed, and then boiling hot distilled or good rain-water, sufficient to cover the petals about an inch, be introduced. The best method of keeping them down is by means of a piece of plate-glass, or the foot of a broken tumbler, or even a piece of common porcelain will do very well. The whole may be kept on the hob of a common fireplace, simmering for two or three hours, covered over with a piece of common paper, to keep out any dirt which otherwise might fall in. The liquor is then to be poured off the petals, which will be found almost colourless. To every pint of the infusion add half an ounce of sulphuric acid, keeping the whole slowly stirred with a slip of glass. When quite cold, add to every pint of the mixture two grains of corrosive sublimate dissolved in a portion of the liquor: filter the whole through a piece of coarse cloth, and bottle it up; and it is immediately fit for use.

When wanted for use, the liquor is to be carefully neutralised by ammonia, which gives it a kind of olive colour, and in this state it may be used liquid; or bibulous paper may be dipped in it, and then dried. Either the liquor or the paper will become green with alkalies, and red with acids.

Being desirous of turning to account some of the qualities of this class of flowers now so much cultivated and so generally admired, and also of rendering them useful as well as ornamental, I have made several attempts to fix it as a dye-stuff on cloths, &c.; but have not yet succeeded in my attempts to my own satisfaction.

The great abundance of these flowers, and the ease with which they can be obtained (as they answer every purpose after having been exhibited,) together with the simple method of obtaining this test liquor, will, I hope, be thought worthy of the attention of the Society of Arts. In conclusion, I beg to add, it has been approved of and adopted at the Royal Military Academy and Royal Institution; and any further information that the Society may require in regard to this subject, I shall feel much real pleasure in communicating when the Society may honour me with their commands.

Ibid.

Lettering Marble.

The Silver Medal was presented to Mr. C. H. Page, of the United States, for his Method of Lettering on Polished Marble; specimens of which are placed in the Society's Repository.

The lettering on marble is, for the most part, confined to monumental inscriptions. For this purpose, the surface of the stone is first polished, and the letters are then cut on it by a chisel, and afterwards covered with black varnish, in order to make them more legible. According to Mr. Page's statement, it is not unfrequent for the letterers, (who form a distinct class of workmen) to content themselves with roughing out the letters in the marble, and to finish them up by penciling on the blacking. Such letters, after exposure for some weeks to the air and weather, become illegible in consequence of the blacking having given way in the superficial parts.

Another method, practised chiefly in the country, is to cut the letters in the marble, and then to cover the space between the letters by some varnish impenetrable to the blacking, after which the blacking is laid on with a broad brush, working it well into the letters. When the blacking has become dry, the surface is to be rubbed with pumice or water of Air stone, which removes the blacking or varnish from the face of the marble, without doing any injury to the lettering if proper care is taken. The surface of

the marble must, however, in this case, either be left unpolished or be polished after the lettering; to which latter there are considerable practical objections.

A third method, sometimes applied to marble previously polished, is to cover the letters and spaces between them with black varnish, and, before the varnish has become dry, to remove it from the surface by rubbing it with a piece of cork, or with an edge of soft brass, which will take the blacking off the surface without injuring its polish. This method, however, is applicable only to very dense and fine-grained marble; for if the surface be porous or flawed, the blacking will sink into the spaces, and cannot be got out.

The method proposed by Mr. Page, and practised by him, first at New York, and afterwards when he was in the employ of Mr. Brown, of University street, is as follows:—

Mix size and whiting to a rather stiff mass, and cover with it the surface of the polished marble, the letters having been cut in it after polishing; then, by means of a brush, work the blacking into the letters, the sized surface being of necessity blacked at the same time. The coat of size prevents the surface, even if porous, from absorbing any of the blacking; and when this latter has become dry and hard, by applying the tool of soft brass, either dry or wet, to the surface, both the blacking and size will be readily removed without injury to the letters, or to the whiteness or polish of the surface. The size, by filling the pores at the edge of the letters, prevents the blacking from soaking through the margin, and thus giving a grey, undefined boundary,—an imperfection to which inscriptions on porous marble are very liable; whereas Mr. Page's method preserves the original whiteness of the marble close up to the edge of the letters.

Mr. Page lays no claim to any novelty in the composition of the blacking. The first used by him he imported from New York; but he has since got blacking quite as good from Mr. Mytton, of Vauxhall Road.

Specimens of his method of lettering on marble were shown in its different stages to the Committee, as well as its successful application to inscriptions on Portland stone; this being one of the most porous stones on which inscriptions are ever cut.

Night Signals for River Steamers.

The Silver Isis Medal was presented to Mr. M. Jenning, for his Night Signals for Steamers.

This form of the apparatus is quite simple, consisting of only two lamps. One is white and stationary; the other, being the indicator, is a coloured light movable about the former. It may, therefore, be placed so as to indicate the course which the vessel is steering without regard to the position of the mast.

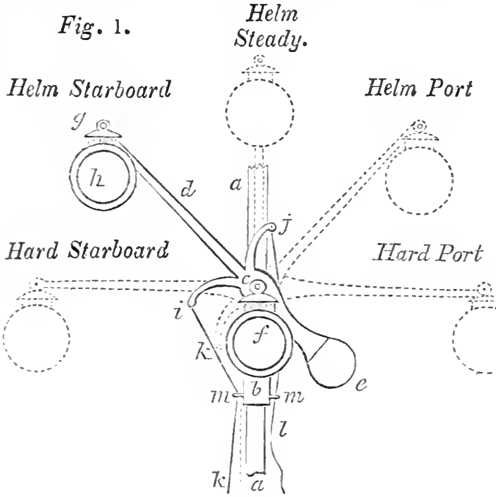
In small vessels it may be mounted on a standard, and placed either on the paddle bridge or near the bow. But in sea-going vessels it may be placed at the mast-head, or on the topmast, by any suitable attachment; or it may be so constructed as to be hoisted by ropes to the topmast like a flag.

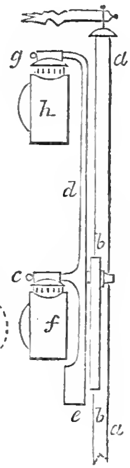
Fig. 1 is a front view, and fig. 2 a side view, of the apparatus as attached to the topmast, of which *a a* is a part: against it is fitted the piece *b b*, from which projects the central pin *c;* on this pin is first placed the arm *d e*, and then the central lamp *f*, so as to swing freely; the top of the arm *d* is also

bent out horizontally at g, in order to hold the coloured indicator lamp h, and let it swing freely. The end e is made heavy enough to bring the lamp h perpendicular over the centre light, whenever it is left at liberty so to do. Therefore, to indicate a right or left course, the arm d must be pulled aside; for this purpose two smaller arms, i and j, project from the arm d, having lines k and l fastened to them, fig. 1; these pass through the guide-rings m m and descend to the deck or to the captain's station.

In fig. 2, the arm d is at liberty; it therefore stands perpendicular: but in fig. 1 it is pulled aside by the line k to the position that indicates helm starboard. The captain, by working the lines, k, and l, informs the vessels ahead what course he is steering, and also indicates to the steersman how he is to put the helm, without the necessity of speaking to him, the back of the lantern being perforated with small holes, through which light enough passes to enable the helmsman to see their position. *Fig.* 2. Ibid.

Fig. 1.





Cupping Glass.

The thanks of the Society were voted to J. L. Fenner, Esq., for the following communication describing a very simple and effectual method of applying the cupping glass.

March 6, 1839.

Sir,—I beg to submit to the Society of Arts my invention to render the operation of cupping (whether with the scarificator or as dry cupping) so simple, that the due exhaustion of the glass—the only point of difficulty—may be readily accomplished by any one with unerring certainty, and without the possibility of any accident. I have found, in my practice, that the application of the exhausted glass (dry cupping) has proved a new source of relief in a variety of diseases, especially the neuralgic, to which the effect of most embrocations and liniments bears no comparison. A far greater number of diseases are relieved by dry cupping than by the scarificator; and it has often proved an excellent substitute for a more painful blister. The true reason why such an important means of relief has been kept out

of sight by the profession is, that as medical men seldom practice cupping, they do not acquire the requisite *legerdemain* dexterity with the spirit lamp; and, therefore, the expensive attendance of a professional cupper is necessary. My patients, after once witnessing my mode of exhausting the glass, are in the habit of dry cupping themselves—a triumph of efficient simplicity which no other mode of cupping could ever boast.

Mr. Clarke's ingenious invention for exhausting the cupping glass, which the Society rewarded, answers very well, and is highly creditable to the inventor. What is the reason that it is not in use? Merely from the additional expense of the sets of silver springs to each variety of glass. Those who do not use the spirit lamp resort to the bungling substitute of lighted tow or paper. For the above reasons, cupping is seldom employed by medical men.

My invention removes every obstacle to its general adoption, and is equally cheap, simple, and efficient. I attach a shred of dry lint, or linen, to the bottom of any kind of cupping glass (or, on emergency, to some forms of tumblers or wine glasses) by means of a moistened wafer. A very little spirit of wine is dropped on the lint, and ignited, the mouth of the glass being held downward, so as just to keep the flame burning until brought close to the part to which it is about to be applied. Next, the mouth of the glass is raised so as to allow the spirit to flare up for *an instant;* then the mouth is to be held downward, and when the flame recedes within the edge, the glass is to be quickly applied to the skin, when it will be found to be duly and satisfactorily exhausted.

I have now two delicate ladies under medical treatment, who have been signally benefitted by dry cupping; each, after only once witnessing the operation, performed it on herself the next and successive times. One of them, dispensing with the assistance of vision, on one occasion, applied the exhausted glass to her *back*, and kept it on more than an hour.

J. L. Fenner.

Ibid.

Newly Invented Gas Light.

On Wednesday, 13th May, the Count de Val Marino, the inventor of a new description of gas, for which he has obtained a patent, explained the nature of his invention, and exhibited the apparatus by which it is carried into effect, in the presence of his royal highness the Duke of Cambridge, the Marquis of Douro, Lord R. Grosvenor, Lord C. Somerset, Sir F. Trench, and several other distinguished and scientific persons, who assembled for the purpose in a building attached to the workhouse, in Mount street, Grosvenor square, where the apparatus is now erected, with the view, it is understood, of the gas being used experimentally in some of the streets in the parish. In order to compare the patent gas with that now in use, three lamp posts have been erected at the top of John street, Berkeley square; one of them is lighted with the ordinary gas supplied by one of the public companies, another, having a burner of precisely the same description with the first, is supplied with the patent gas, while the third is not only lighted with the new gas, but is furnished also with a burner invented by the Count de Val Marino.

The apparatus for preparing this new gas was temporarily fitted up for this occasion, and the manner in which the gas is generated was explained in a very satisfactory manner to his royal highness and the company by the

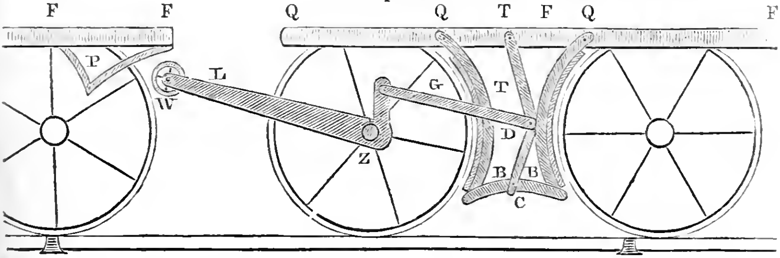
Count de Val Marino, who speaks only in the French language. He pointed out the particular construction of the furnace, and its arrangements in the following manner, as nearly as we could collect the facts:—There are three cylindrical retorts placed vertically side by side, and inclosed in a furnace of suitable dimensions to heat them up to what is technically called a red white heat. This is obtained in a short time, with but a trifling cost for fuel. The requisite heat having been obtained, water is allowed to drop rapidly, but not to stream, into the first retort, and tar into the third one. We must here observe, that the three retorts are charged with coke broken into pieces about the size of a walnut. In the first retort the water is decomposed, the hydrogen is separated from the oxygen, which, uniting with a certain portion of carbonized vapour, produces carbonic acid gas. This product, with the liberated hydrogen, now passes into the second retort, and it is in this retort that the carbonic acid gas is changed into oxyde of carbon by passing through the heated interstices of the coke. The liberated hydrogen, with the other products, unite in the third retort with the superabundance of carbon which is produced by the decomposition of the tar, and thus is formed a pure carburetted hydrogen gas, not requiring any further purification.

The proportions of the water and tar to each other for producing the purest and strongest gas, are, three parts of the former to one part of the latter substance—consequently, the materials being very cheap, the product cannot bear any great price.

This gas seems to be a very active and powerful agent, as it appeared in juxtaposition with the common gas, and when carefully prepared, the flame it produces is clearer, and consequently more bright, than the same surface of the ordinary gas, and there are street lamps lighted from eight to nine o'clock in the evening in the street at the rear of the workhouse looking into Hill street, where the qualities of the two gases can be accurately compared.

Lond. Journ.

Self-acting Safety Brake, for bringing up Railway Carriages with Ease and Expedition.



Sir,—I need not inform the scientific portion of your readers, that a surer and more expeditious method of bringing up railway trains, whilst traveling at high velocities, in cases of emergency, has been a deficiency long felt by those connected with locomotive machinery, and which the following plan will, I think, adequately supply.

Here it will be at once seen, that the old enemy, who hitherto has stared us full in the face, is converted into a friend of no ordinary worth, if there be any truth in the old saw, "a friend in need is a friend indeed."

Supposing a railway train to be traveling at a great velocity, the steam sud-

denly cut off, and a powerful manumotive brake applied to both engine and tender alone, the sudden check will cause the whole train to rush together with considerable violence. Now this property of the carriages rushing upon one another, is converted into the stopping power, or agent, the carriage following, acting upon the brake of the carriage in advance.

The prefixed figure is the carriage in advance, having the new brake attached: the near wheels are removed for bringing the parts into view.

B, B, are the brakes faced with wood, turning upon their centres, Q, Q; C, a curved spring for releasing the brakes, and strong enough to resist the required pressure; T, a knee joint turning freely upon the centres, T, D, E, to which is attached a bar, G, to which latter bar is attached the lever, L, having its fulcrum at Z. Power is to be applied at W, which is depressed by the inclined plane, P, of the following carriage running upon it; W, a roller the breadth of the carriage.

It will be seen from the above plan, that each carriage can be fitted with eight brakes, so that in a train of twelve carriages (the brakes on the last carriage being idle) we should have no fewer than *eighty-eight* brakes ready for action in an instant, and under the immediate control of the engineman and assistants, with the amount of stopping power always coinciding with the momentum of the moving train. Yours, &c.

Manchester, May 25, 1840. WM. JONES.

Lond. Mech. Mag.

Improvement in Mr. Smee's Galvanic Battery.

Sir,—the very superior galvanic battery recently discovered by Mr. Smee, in which platina is precipitated upon silver, or copper plated with silver, suggested to me the trial of another metal in the place of silver; but before I give an account of these experiments, permit me to state, that since the appearance of your Magazine containing the directions for making Mr. Smee's batteries, I have had one made and tested it. It consists of 24 silver plates, size 7 by 10 inches, divided into six elements or pairs, and although finished but a few days since, I have kept it almost constantly in action, and its effect, as compared with the old batteries, far exceeds the most sanguine expectations I had formed of it.

The expense of the plates was great, and recollecting, while preparing them, that iron immersed in a solution of sulphate of copper, without any previous preparation, almost instantly becomes coated with that metal, the experiment was made with *iron* in nitro-muriate of platina. To my surprise, a coating of platina formed on the iron almost immediately, and with much greater facility than on the silver plates. In consequence, a battery has been made of 20 small iron plates, platinized, of about 2 inches by 3 in size, and the result is a power every way equal to a battery of silver plates. The process is in both cases the same, except the washing the plates with nitric acid previous to platinizing; but the iron does not require one-half the time to prepare it that is required by the silver.

Apart from the comparative cheapness of this battery, many other advantages may be mentioned. In using silver, it being susceptible of action from the mercury used in amalgamating the zinc plates, the electric action projects some particles of mercury from the zinc upon the silver plates, and from this cause their action and effect gradually diminish. Iron having less affinity for the mercury than the zinc, is not attacked by it, and no perceptible diminution of its effect or action takes place for hours, and after repeated trials of some

hours each, is found to be as good as at the first immersion. The acid used is the same as directed by Mr. Smee, viz. one part sulphuric to seven parts of water. No porous tubes, canvas or paper bags or sacks, are required to preserve the platina.

I have now in progress a large battery of thirty iron plates to be divided into six elements, or pairs, my object being quantity rather than intensity. I need not dwell upon the advantages this discovery offers in regard to its cheapness, its freedom from noxious gases, or its equal and constant action. I have only ventured this communication in the hope that others possessing greater experience, science, and opportunity than myself, may make still further and more important discoveries.

I am convinced that the *iron battery*, from its many advantages, is an important step towards the adaptation of electro-magnetism to useful mechanical, as well as chemical and scientific purposes.

I remain, Sir, your obedient servant,

Paris, May 31, 1840. JAMES H. PATERSON.

Ibid.

Rain Gauges.

Sir,—In turning over the pages of your useful miscellany, I find at page 163, vol. viii., the following method of constructing a rain gauge:—

"Take a funnel whose opening is exactly ten square inches, and fix it in a bottle; as the rain descends it will fall into the funnel, and from thence into the collecting vessel. The quantity of rain caught is ascertained by multiplying the weight in ounces by .173, which gives the depth in inches and parts of an inch."

This rule will be limited in its usefulness from the circumstance that parties wishing to construct such a gauge may not be able to command a funnel the area of whose opening is precisely ten inches. How many shops may require to be searched before one can be found, or who will undertake to make one, the diameter of whose opening shall be 3.568 inches? In these circumstances, it occurs to me, that a method of finding a multiplier adapted to any other area of funnel may be acceptable. If you are of the same mind, I shall feel obliged by your giving insertion to the following:—

Let d=the diameter of the opening of the funnel; then will $d^2 \times .7854 =$ its area. Also, let $a =$ the altitude of the column of rain fallen; then will its contents, or the quantity received by the funnel, be expressed by $a\ d^2 \times .7854$. Now, a cubic foot, or 1728 cubic inches of water weighs 1000 ounces avoirdupois. Therefore, to find the weight of the quantity of rain received by the funnel, we have the following analogy:—

$1728 : ad^2 \times .7854 :: 1000 : ad^2 \times .454$. That is, calling the weight w, $ad^2 \times .454 = w$. Whence, $a = \dfrac{w}{d^2 \times .454} = w \times \dfrac{2.2}{d^2}$ Hence, the rule is, *divide the constant quantity 2.2 by the square of the diameter of the funnel; the quotient will be a number by which, if the weight in ounces of the rain in the receiving vessel be multiplied, the product will be the height in inches of the column of rain fallen.*

This multiplier once found, it will be advisable to inscribe it on a conspicuous part of the funnel to which it corresponds.

To exemplify the rule, I may give an example: suppose the diameter of the

funnel is $6\frac{1}{2}$ or 6.5 inches. Then $\overline{6.5}|^2 = 42.25$; and $\frac{2.2}{42.25} = .052$, the multiplier required. Or take as another example the funnel, the area of whose opening is 10 inches. The area being equal to $d^2 \times .7854$, we have $\frac{10}{.7854} = 12.7324 = d^2$. Hence, $\frac{2.2}{12.7324} = .1728$, the correct multiplier, instead of .173, as stated in the article I have quoted. Now, if the rain collected in the receiving vessel weigh $27\frac{1}{2}$ or 27.5 ounces, we have in the case of the first funnel, $27.5 \times .052 = 1.43$ inches; and in the case of the second, $27.5 \times .1728 = 4.752$. I am Sir, your obedient servant, Q.

Aberdeen, May 4, 1840. Ibid.

Notices from the French Journals. Translated for the Journal of the Franklin Institute, by J. Griscom.

Analysis of Osmiuret of Iridium. By M. Dobereiner. (*Ann. de Pog. t.* 35.)

Having melted osmiuret of iridium with persulphuret of sodium, and washed the mass in water, we have a deep green liquor, from which acids precipitate sulphurets of a deep gray colour. The residue of the washing is afterwards completely oxidized by treating it with one part of carbonate of potash and two parts of nitre.

The osmium is easily precipitated, even from its alkaline solutions, by formic acid. It then appears in the form of a deep blue powder, and is so combustible that it detonates with chlorate of potash. Ann. des Mines, tom. xv.

Note on the metal-cleansing property of a double Chloride of Zinc and Antimony. By M. Golfier-Besseyre.

There is a double chloride formed of joint equivalents of chloride of zinc and sal-ammoniac, easily crystalized, sometimes in plates and sometimes in prisms, according to the dilution or acidity of the medium; but always forming rectangular parallelograms, the solid angles of which are often truncated, so as to present hexagons very often of the diamond form, susceptible of increasing in every direction, and forming either hexahedral prisms or hopper shaped forms, &c.; in short, it has a great tendency to crystalization.

It is very soluble; water takes up more than $1\frac{1}{2}$ times its own weight at common temperatures, and $3\frac{1}{2}$ times at a boiling heat. The solution is very rapid, producing great depression of temperature.

Heat decomposes it into hydrochlorate of ammonia, which sublimes, and chloride of zinc, which dissolves. The most remarkable property of this compound is the facility it affords in tinning or coating metals. It is easy, by means of this salt, to cover copper or iron with tin, lead, or zinc; zinc with tin or lead; and even tin with lead, and the reverse.

It appears to cleanse so well the metallic surfaces to which it is applied, that the metals form, immediately on contact, the alloy on which metallic coating depends; at least it is thus that I explain this singular experiment—of

coating a plate of tin by means of a plate of lead, and reciprocally a plate of the same lead with a plate of the same tin.

The advantages derivable from this are very great; the cheapness with which this substance may be procured allows of its common use. Some of the applications I have already made are—coating a sheet iron kettle with lead simply, which has been in use about two months, for the crystalization of fluids which contain an excess of sulphuric acid, without any alteration being discoverable; all the instruments employed with this kettle, whether of copper or of iron were coated also by means of lead.

From motives of economy, I had several large vessels made of zinc, as well as covers of tubs and boilers; but very soon the united action of air and steam, of heating and cooling, deteriorated the vessels, and oxide of zinc came off from them sometimes in very thick plates;—to have made them of tinned iron would not have comported with my views of economy, and besides commerce furnishes the material only in small sheets. I coated with tin the surfaces exposed to the injury, and I am at present well satisfied with the effect. This double chloride, I conceive, acts as a reducing substance, for I had a large sheet iron stove in the laboratory, so much degraded by oxidation, that in many places it had holes in it. I coated it with lead, and it has become like a new stove.

It is the solution of this substance particularly that must be employed, for it is essential that the surfaces to be coated should be moistened so that the little cavities which oxidation has made may be exposed to its action. I mention this because several persons appear to adhere to the use of it in powder; but it happens in this way as it does with borax in soldering.

If we borax a piece with water holding borax in solution and suspension, its preservative action commences at the boiling temperature; for the water leaves borax over the whole surface of the piece to be soldered; but if we use it in powder, success is much more uncertain, for the powder first calcines, then melts into small drops, which leave intervals exposed to the oxidating action of hot air, and it is only at the temperature of bright redness that it spreads over the surface so as to facilitate the combination of the solder with a metal. Ann. de Chim., Juillet, 1839.

Grease adapted to Carriages and Machines of all Sorts.

This composition prevents friction to a great extent, and of course lessens the wear of all rubbing surfaces. Its cost is not comparatively greater than the materials often employed for the purpose. It is not changed by heat, and hence does not liquify and flow away from its proper place.

Recipe.	Black lead, pulverized, .	50	parts, by weight.
	Hogs' lard, . .	50	do.
	Fresh soap, . . .	50	do.
	Quicksilver, . .	5	do.

At first amalgamate well the lard and mercury, by rubbing them together for a long time in a mortar. Then gradually add the black lead, and lastly the soap, mixing the whole as perfectly as possible. Rec. Soc. Polytech, Jan., 1839.

Application of Caoutchouc Tubes.

By means of these tubes, a person seated in the back part of a carriage, may give directions to the coachman, as secretly as he pleases; the latter ap-

plying his ear to the end of the tube outside, perfectly understands the voice within. An application not less useful, is that of a person in a diving bell. By having two tubes of caoutchouc adapted to the bell, one for the descending and the other for the ascending voice, a communication may be held at the depth of 50 or 60 feet, very easily, and much more rapidly than by writing on plates of lead, and transmitting them upwards and downwards, a method sometimes practiced. Idem.

Pancratic Microscope.

This instrument was invented by Prof. Alex. Fisher, of Moscow, and is executed by Chevalier. It has the special advantage of producing at will, without any change of pieces, and by an easy and almost invisible movement, a diversity of magnifying power, varying from 270 to 560 diameters for transparent bodies, and from 75 to 235 for opake bodies. There is, at the same time, indicated on the body of the instrument the degree of enlargement, corresponding to each degree of the elongation of the tube. This advantage, without any sacrifice of the neatness and clearness of the image, will be highly appreciated by observers, who often have occasion to study the same object under different degrees of amplification, occasioning, in the common construction, a considerable loss of time. The committee of the Athenæum of Arts has expressed an entire approval of the ingenious construction of this fine instrument. Idem, Avril, 1839.

Iron Cottages.

A model of a cottage, entirely constructed of iron, has been exhibited in Glasgow, of an elegant structure, and so well adapted to the purposes designed, that no doubt can be entertained of its fitness for general adoption, as well on the English coast, as in the interior. The model contains six chambers, a kitchen, wash-house, and other conveniences. A cottage constructed according to this model, would cost 250*l.* sterling. A double house, that is, one containing fourteen chambers, would cost 500*l.*, which is not half the cost of a similar one built of common materials. Besides, it could be prepared in the course of two months. The iron trade of a country might gain much by this kind of construction. Idem.

Preserving Fruit from late Frosts.

The fruit of trees whose precocious bloom exposes them to the destructive influence of late frosts, may have their flowering retarded by a removal, during the winter, of the earth around the roots; so as to permit the frost to descend deeper, and thus to check the too early ascension of the sap. Many southern horticulturists have resorted to this plan with respect to their almonds, apricots, peaches, &c. In this way the flowering has been retarded more than a fortnight, and late frosts have not attacked them. Idem, Mai, 1839.

Fulminating Mercury. By M. A. Chevalier.

The history of the fabrication of this article in France, may be interesting to many readers. Howard's process for making it is to dissolve 100 grains

of mercury in an ounce and a half of common nitric acid, by measure, aided by a gentle heat. When cold, pour the solution on two ounces, by measure, of strong alcohol, and if action does not immediately ensue, aid it by a little heat. If the effervescence becomes violent, check it by a little cold alcohol or cold water. When the powder ceases to form, separate by a filter, wash it well with water, and dry it by spreading out the filter in the air. From 100 to 122 grains of the fulminate is obtained from 100 of mercury. Its colour is not always the same in every process, but varies from dark to white. It detonates by heat, by percussion, by the flint and steel, and by the electric spark.

After its discovery, it was tried as priming powder, mixed with wax, with alcoholic tincture of benzoin, with nitre, with sulphur, and with sulphur and nitre together.

The manufacture of fulminating powder for priming was commenced in France in 1816, by Julien Leroy, in connexion with his father-in-law. He tried fulminating silver, but was killed by an explosion in his laboratory. After his death, his brother-in-law, M. Daguere Leroy, in connexion with a partner, continued the business, but a son of the partner became also the victim of an explosion.

From this time to 1826, various accidents occurred from the detonation of fulminating powder, among which was the death of an apothecary at Versailles, and a similar occurrence at Saint-Etienne.

In 1826, M. Gevelot, one of the ablest fabricants of the capital, purchased the materials which had belonged to Julien Leroy, and established a factory at Moulinaux. Some accidents occurred here, but no death.

M. Gevelot afterwards erected a new factory; but, though well managed, an explosion took place in 1827 and another in 1834, which were attended with the death of several persons.

The employment of copper capsules dates from 1819. By these the danger from the use of fulminating compounds in priming powder, was greatly lessened. New factories were started, but various accidents occurred among them:

1st. In 1826 or 1827. A fire having reached the factory of Tardy & Blanchet, at La Gare d'Ivry, the materials exploded and killed several persons who were engaged in extinguishing the fire.

2d. In 1828, at Gentilly, a child engaged in charging the caps, was killed, and another person wounded.

3d. In 1829. By the pressure of the lid of a box, about which were some grains of powder, the owner of a fabric and another person were killed.

4th. At Belleville, one or two persons were killed.

5th. At Joigny, several persons lost their lives.

6th. At La Villette, a man and a woman were killed.

Various other accidents are mentioned in the history of this manufactory. The government enacted strict regulations relative to the manner of conducting it, and notwithstanding the danger it involves, it has become an extensive object of manufacturing industry. In 1835, eight hundred millions of percussion caps were delivered from the factories, from three to four hundred millions of which were exported to foreign countries, and the rest consumed in France. This branch of industry required 80,000 kilogrammes (=176,000 lbs.) of sheet copper, and 200 pipes of alcohol, which paid a duty of 100,000 francs, and from 160 to 170 kilogrammes of nitric acid, 15 to 16,000 of mercury, 7

to 8000 of nitrate of potash, 2000 of sulphuric acid, for cleaning the copper, and 1590 kilogrammes of cast steel.

A manufactory of priming powder was established at Prague, by Bellot, a French chemist, which furnished annually from 40 to 45 millions of caps, but they were differently prepared from those in France. The latter are made of fulminating mercury and nitre; the capsules prepared at Prague, and which it is said answer better, contain sulphur in addition to the fulminate and nitre.

The priming powder is manufactured, in the large way, as follows: Into a large glass balloon are introduced

1 lb. 8 oz. of mercury,
18 lbs. nitric acid, at 36°, as pure as it is possible to obtain it;

the mercury is dissolved by the aid of a gentle heat, and when complete, 8 to 10 or 12 quarts of alcohol are added by degrees. An enormous quantity of hypo-nitric acid, mixed with ethereal vapours, are disengaged, which are so diffused throughout the place as to reach the olfactories of persons on the road, and to affect the workmen very unpleasantly.

When the alcohol has completed its reaction, it is left at rest for some time, then poured out into basins, the liquid drained off, the powder washed with a little pure water, and then separated by filtering through linen bags, placed in glass funnels.

From 26 to 30 ounces of fulminate are obtained from the materials above mentioned. Its quality depends much on the quality of the nitric acid employed.

While still moist, the fulminate is mixed with the third of its weight of nitrate of potash. This operation is performed on a table with a wooden muller, and which, as the materials are moist, is not dangerous.

The next operation is graining. The mixture being too moist to pass through the sieve, it is dried by means of *pulverin*, obtained from the dry cakes; this mixture is made in stone vessels, and is liable to produce detonation. It may be done on a hair cloth, or on stretched muslin. It is granulated by a hair sieve.

The granulated powder is put on papers, which are placed on thin wooden boards, and adjusted on small tables around the drying room; when taken to the sifting place, these papers should be thrown into water, or, better, into muriatic acid.

The sifting is done on a hair sieve. By this the powder is divided into two parts; the coarser being the powder, and the finer the *pulverin*. The former is then to be put into bottles or pouches made of leather which has been boiled, or of varnished pasteboard, and deposited in the *powder room*, expressly isolated and kept carefully locked.

The prepared powder is afterwards divided in little pasteboard bottles, and taken to the charging room, where it is put into the little capsules, some fabricants adding a small quantity of gum mucilage, that the powder may not get loose and separate from the capsules.

M. Bellot, as has been mentioned, adds sulphur to the other materials in his powder. His proportions are,

Nitre,	1170
Sulphur,	230

This mixture is added to the fulminate in the proportion of

Fulminate of mercury,	350
Preceding mixture,	450

Fulminating powders are carried by pedlars into Germany, it is said, from

France, made by venders in various proportions, some of which I have examined and find to contain from 40 to 60 per cent of nitre.

Certain restrictions, recommended by the committee of safety, are imposed on the manufacture of percussion powder—the principal of which are: the floors of the workshops to be in plaster, as the fulminating powder cannot be exploded on this, though struck by a steel hammer—to bring from the powder room to the charging room, at a time, only one-eighth of the quantity to be used through the day—to sweep the shop often, and to throw the sweepings into a river or stream of water—to keep water in large quantity in the shops—to forbid fire at all times in them, and to warm them, if necessary, only by steam—the factory to be completely at a distance from every dwelling, and from public roads, and to be surrounded by walls—no wire sieves to be employed—the bottles of dried powder to be cased with rushes—the powder room to have a lightning rod, and the floor to be covered with lead—no powder to be poured out or transferred in this room, under any pretext whatever—no factory to be established without a previous submittal of its plan and arrangement to the proper authorities for approbation.

Rec. Soc. Polytech., Juillet et Aout.

Blackening the Hair.

At the Society of Pharmacy in Paris, (Feb. 5, 1840,) on the occasion of discussing a formula for a fluid proper for darkening the hair, as contained in the Pharmacopœia of Geiger, cited by M. Guibourt, M. Robinet stated that in China the colour of the hair is changed by an internal application, (traitement intern) which blackened it for life. A French missionary, who went from France with red hair, returned with black hair, after following this prescription.

Idem.

Progress of Civil Engineering.

Suspension Bridges.—Letter from Lord Western to Lord Melbourne, descriptive of a Suspension Bridge on a new principle, built across the Avon at Bath, by Mr. Dredge. (Slightly abridged.)

My Dear Lord—Having heard that Government is about to expend a further sum of money on the reparation of the Menai bridge, which is said to be in a perilous state, I cannot refrain from entreating your attention to the vast improvement that has been made in the construction of suspension bridges, by Mr. Dredge of Bath. During a recent residence of two months in that city, I have had an opportunity of seeing often the bridge built by him across the Avon; it is a beautiful structure, and at once commands admiration by its beauty, and inspires confidence in its stability. I have communicated with him frequently about it, and altogether the consequence has been so strong an impression upon my mind of the *vast* and *immeasurable superiority* of the principle on which it is built, over anything that has hitherto been attempted, that I have been led into this somewhat extraordinary intrusion upon your Lordship, on a matter with which I may be, I own, justly considered to have no very intimate or scientific acquaintance; such, however, is the *simplicity* of the work, that I will not hesitate to at-

tempt some account and explanation of it, in the hope of drawing your attention in the first instance, which if I accomplish, you will be led, I think, to give it a closer examination, which will produce eventually as strong a conviction in its favour on your mind, as it has produced upon mine.

Mr. Dredge's statements of the superiority of the power of his system over the established plan of structure certainly at first astonished me; he has, however, *proved* by *trials* in the presence of very many persons, a superiority of strength to the extent of at least *one hundred and fifty per cent.* These were made upon small models of bridges formed severally on the *present* and on his *new* principles, each out of the same quantity of iron. But Mr. D. carries his calculations of the accumulating power derivable from size and extent over and above the one hundred and fifty per cent. shown upon the small models, to such a degree that I will not venture to state it, but if he should be called upon, in the way I trust sooner or later he will be, to exhibit his system before your lordship and the public, he is confident he can *mathematically* and *practically* establish any of the statements he may make, and I have little doubt he will be found to be correct. He insists on the possibility of reconstructing the *iron work* of the Menai bridge at a *less* sum than the *superfluous iron* would *sell for*—so much less is *requisite* than was *there* used; and he pledges himself to the power of the bridge, if the irons are altogether altered and reconstructed on his principle, to be *capable* of supporting on transit 1000 tons. The Menai bridge is believed to have cost near £150,000, and to have consumed in its construction above *two thousand tons* of iron, and to be declared only capable of sustaining 733 tons on transit. Before I submit to your lordship a detail of some practical experiments Mr. Dredge has made, justificatory of the declarations he thus ventures to put forth, I will endeavour to give some explanation, imperfect though I am sensible it must be, of the fundamental principle upon which his mighty fabric is erected. I must give it merely as it has struck my unlearned common sense, and which it has from *its simplicity*, with a force so irresistible that it makes me believe I fully understand it. * * * * *I conceive the grand foundation may be said to be the rendering the chains strongest*, and *indeed very much the strongest*, *at the base*, *tapering them by regular degrees to the centre*, where they *come at last in fact to a cipher*; from the cipher *commence*, therefore, their *size*, *weight*, and *strength*, which regularly *increase by degrees* quite *up to its base*, which base, you know, in a suspension bridge, is the towers of masonry on which the chains are hung: in truth it is the application of that *principle horizontally*, which is so obviously necessary in all *perpendicular* erections, of superior size and strength at the base, and *tapering* away to a cipher on its ultimate summit;—as, for example, the obelisk, the pyramid, the church spire; and which principle he shows to be as effective *horizontally* applied, as it is in the *perpendicular*, indeed it may be said to be *far more effective*, as it has to support in so difficult a position, comparatively with the *perpendicular*, its own intrinsic weight, and a heavy transit load besides. * * * * * * *

Mr. Dredge's bridge may be well imagined by supposing a church spire laid horizontally, and met by another of equal dimensions at the point.

There is another figure by which the principle may be more clearly shown; it is the *bracket;* every body knows that the bracket, tapering from its base, will bear horizontally a great weight, but if it was the same size from its base to its extremity, though it might continue to be called a bracket, it would hardly sustain itself if it was any considerable length. I have to

remark now, upon another most important peculiarity in Mr. Dredge's bridge, and that is the diagonal direction of the road suspending rods, instead of the perpendicular, and forming, therefore, as it unquestionably does, a powerful contributary effect to the support of the whole; and this is also most easily capable of direct practical proof. There is a still further point of difference and advantage in Mr. Dredge's bridge, which appears to me equally simple and proveable, and which also essentially contributes to increase its aggregate power and security; that is, its *horizontal action*, or *pressure*, which is also made obvious by a simple and familiar figure representing one-half of a bridge; suppose a straight rod of any given length; fasten a cord at one end of it, and thence to the top of a wall, place the other end to that at which the cord or chain is fastened against the wall, at such a distance below the top of the wall as will render the position of the rod horizontal, and it must be plainly seen that the rod is supported as well by its *compression* against the wall at one end, as by its cord of suspension at the other. Thus every component part of the structure is brought harmoniously to work, and in perfect unity of action towards the grand object.

I will now advert again to the Menai bridge, and show further in essential points the difference between that, and indeed most other suspension bridges, and Mr. Dredge's. The actual intrinsic strain at the centre of the Menai bridge, according to Drewry, p. 167, amounts to 1878 tons, and at each extremity, 1943 tons; this vast intrinsic weight operates in its own destruction, increasing its self-destructive power as it increases in length: thus it becomes vibratory, and upon a gale of wind blowing upon its broadside, it has a swing or pendulous motion; this I have felt myself in passing it, the wind blowing strong at the time.

On the other hand, as I have observed before, upon Mr. Dredge's principle, the *strain* and *weight* only *commence* at the centre, *increasing* as the strength of the bridge *increases* up to the base, and of course its ability to sustain it; this difference between these two systems may be readily imagined by supposing a ton of iron formed into a bar of equal dimensions from one end to the other, and fixed into a wall; it will hardly support itself, still less any additional load; if extended to any considerable length, it will not support itself; on the other hand, make the same weight of iron into a taper form, and it will support its own weight to any extent, and a heavy extrinsic weight in addition. But further than this, if the parallel equal sized bar is cut away by one-half, it will then support itself and an extrinsic weight in addition. The reason is obvious—it has discharged itself of that which was altogether superfluous, and therefore noxious in the extreme, being wholly destructive of power to carry any extrinsic weight. In this figure is a singularly accurate exemplification of the vice of the Menai bridge, and others built upon the same principle, and the obvious good sense of Mr. Dredge's. Thus, his genius has led him, by the *simplicity* and *perspicuity* of his conceptions, to effect a discovery, which I firmly *believe* will turn out of great national importance, the recognition of which by the country will I am sure be felt by him as the highest possible reward.

Having thus endeavoured to show the simple principle on which Mr. Dredge's system is founded, I proceed to give you some account of some experiments he has made, practically substantiating the truth of it, prefacing them however with a brief description of the expense and particulars of the Victoria bridge across the Avon, built in 1836, and which has proved itself equal to its inventor's most sanguine expectations. Its cost was 1650*l.*, its span is 150 feet, and only 21 tons of iron were consumed in

its construction, which at 20*l.* per ton, is only 420*l.*; the great expense, therefore, was on the masonry and the timbers supporting the platform, or road, which are still of insufficient dimensions and strength, but which of course are quite unconnected with the principle on which the bridge is built; the chains are under 10 tons, and are equal to sustain 500 tons on transit. In November he began putting the chains of this bridge together, and in the following month it was open for general use; its road is stoned like common roads. In further proof of the correctness of this system, tests have been made before various parties at various times, viz. at Bath, January 2, 1838, before Messrs. Worsams from London, Ball, Cambridge, and others of Bath, with models whose *lengths, deflections*, and *weight were equal*, the chains of each model between the fulcrums were only 9 oz. of wire, their spans were 4 feet 6 inches, their deflections 6 inches, and their platforms were 2 feet. The parallel chain model (old system) broke down on putting 6 sacks of beans on its platform, weighing about 13 cwt.; the taper chain model (new system) bore the 6 sacks of beans, 7 sacks of malt, weighing 10 cwt., 2 cwt. of iron, and 11 men, at the same time, all of which did not break it down. In Bristol, January 6, 1838, before Messrs. Protheroe, Guppy, and others, two other models of equal material and dimensions were tried; the parallel chain model bore 1565 lbs., the taper model bore 3681 lbs. Again, in Bristol, January 10, 1838, more trials were made before Messrs. Acraman, Daniels, Hillhouse, and many other of the first merchants of Bristol, Dr. Waldren and many others of Bath, with models of equal material; the parallel chains bore 1456 lbs., the taper chains bore 3696 lbs. Another trial before the same party, on the same day, was made with models constructed by Mr. Cross of Bristol, unknown to Mr. Dredge, in order to prove that all was fair in the former trials; and the result was, the parallel chains bore 2632 lbs., and the taper chains bore 6849 lbs.; each model broke on adding more weight, and the wire throughout on the taper principle was reduced one size by the experiments.

Now, my lord, all I request is, in the event of further repairs or improvements being about to be undertaken of the Menai bridge, that you will allow Mr. Dredge to exhibit some similar experiments before your lordship, or the Treasury, or before the Bridge Commissioners, and in the presence of any of the most eminent engineers you may choose to summon; finally, my lord, Mr. Dredge declares that such is his thorough conviction of the truth of his theory, and its facility of execution, that he would gladly undertake, at his own expense and risk, the *whole of the iron work*, if he should be allowed to reconstruct it, which he believes he could do, the bridge standing all the time, and that it should be competent to sustain 1000 tons on transit; the superfluous iron of the present bridge he is pretty confident, would pay him and give a balance in favour of government.

Questions may after all fairly be put to me to learn why, with all these advantages of Mr. Dredge's system, exhibited with so much apparent fairness, has not his principle been at once generally acted upon? Why has he not been called upon in many cases to execute what he thus promises? Why, if he can build the proposed Clifton bridge, as he says he could, for one-third or less than Mr. Brunel's estimate, is he not called upon to do so? One good reason is obvious: a prudent caution on the part of the public disinclines them to overthrow long established systems, and to oppose or even question the judgment of long known and respected authorities; this feeling operates very naturally and happily in philosophy as well as in politics, but it should not in either be carried to the extent of checking the progress of

provement, by well considered means; too great a tenacity for old sysns may exist in the minds of many persons, though their motives may be od, and their minds not illiberal; Mr. Dredge's principle of suspension idge building completely overthrows the theory and practice of a Telford , Brunel, whose experience and talents we are bound highly to respect, and whose genius I readily offer the humble tribute of my admiration. Can then be surprised that the public should evince some fear and some re-tance hastily to adopt Mr. Dredge's novel principle or theory, in subtution of that which has been so long acted upon? They ought, theree, to pause, they ought to inquire, if there are any persons about to di-t the construction of other suspension bridges; it is a duty they owe to se for whom they may be acting, to examine fully into the merits of a vel system which *promises fairly* such advantages, before they determine persist in the further adoption of the present, of the correctness of which state of the Menai bridge, and the vast expenditure it occasions, y well create a doubt, independent of the obviously faulty principles on ich it is, I think, clearly shown to be constructed. No human being s ever exempt from error, and Messrs. Telford, Brunel, and others, must be considered to be infallible. I have only to add, my dear lord, that making this address to you, I have no other motive than the desire of isting to bring forward genius, and secure for the country the benefit of most valuable discovery and work of art, which appears to me for want of t encouragement which I think it merits, is in danger, like very many ers, of being lost sight of altogether. WESTERN.

To the Viscount Melbourne.

Wood Pavement.

From the experience had, there seems very little doubt but that wood vements will come into general use in the capital and all great towns. e easiness of draught, the absence of noise, the exceedingly small quany of wear and tear, give it a superiority over every kind of paving yet d for carriage roads. Nor do these qualities appear to have any *per con* set off in expense or the rapid wear of the blocks: So far, indeed, from that there is every reason to believe, from the experience already had, t ordinary fir blocks will last for many years in their natural state, if ll laid, at an insignificant annual expense of repair. And if they were to Kyanized, there is no telling to what term they may endure, for the wear pears to be exceedingly small.

The principle of wood pavement being once admitted, the next question as to the best form of blocks, and the best method of laying them down. the first specimen laid, at the east end of Oxford street, the blocks were lependent hexagons, about nine inches long, and six diameter, the grain ng vertical, and the bottom a well prepared Macadamised ground. This od so well, after twelve months trial, as to bring the wood into immediate utation. Still it was evident, from the partial subsiding of the blocks, t some improvement was wanting. Though, as a whole, the pavement od the test of twelve months wear exceedingly well, there was evitly a want of what may be called coherence, or bond of aggregation of road. Each block stood alone; each had to bear the weight as it came it, and there was no means of calling in the assistance of its neighbours. therefore, every one was not equally strong, or equally well supported,

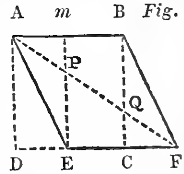
it naturally gave way, and left the road here and there in hollows, which, though not very glaring, were obvious enough after a shower of rain. From the smoothness of the surface, it also, in greasy weather, became exceedingly slippery.

Succeeding this, was another attempt in the Old Bailey of the same kind, which did not succeed.

Another similar one in Broad street, St. Giles's, required considerable repairing immediately after.

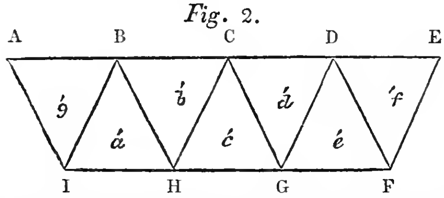
At length, in the summer of 1839, a plan was proposed by a foreigner, (we believe the count de Lisle) in which he proposed forming the blocks in a peculiar rhomboidal shape, by what he calls "a new section," or "stereotomy of the cube." Without following the author through all his details of superiority of this new section, as he calls it, we shall here describe it, and show, as far as we can perceive them, the practical advantages of his plan.

Fig. 1.



Description.—Let A, B, C, D, fig. 1, be a square, and let the base, D, C, be bisected in E. From E draw A, E, and complete the parallelogram, A, B, F, E, which will be the longitudinal section of his block, the transverse section being a square. If now perpendiculars be let fall from the obtuse angles, E, B, on the opposite sides, A, B, E, F, they will cut the diagonal from the acute angles, A, F, in points, P, Q, which will be the points of connexion or tie for the adjacent rows of blocks. These rows are so placed that alternately they run or lean the same way, but adjacently the opposite. Thus if we suppose the row of blocks, (fig. 2.) A B H I, B C G H, C D F G, all leaning towards the north, the adjacent rows on each side of it, as C B I H, D C H G, E D G F, will all lean towards the south. By this means, the two pins, *a*, *b*, of the block, C B I H, coincide respectively with holes in the blocks, A B H I, and B C G H. So that if they are thus pinned, every block of one row breaks the joints of the adjacent rows, and is pinned to the two whose joints it breaks. Hence there is formed a continuous and compact body, in which the pressure is distributed over a considerable surface.

Fig. 2.



If we examine more minutely the properties of these blocks, we shall find a peculiarity in their shape, as thus pinned together, which gives them the power of distributing the pressure much superior to that of the upright hexagonal blocks. In the hexagonal blocks, a weight upon any one block is wholly supported by that block during the entire time the wheel or body is passing across it, if unconnected to the others with pins; and if it is connected, then nearly the whole pressure, if the ground beneath it is at all yielding will be borne by the pins, which must of course tend much to break them. But if we take one of the present blocks, in no instance can it have to sustain the whole pressure for more than over one-half of its surface. For if we refer to fig. 1, we shall see that the block, A B F E, sustains the whole pressure only when the weight is between *m* and B. When between

m and A, it is partly supported by the preceding block, by a direct pressure of one block upon the other. The mere keeping of the two blocks, therefore, together, which the friction of the subsoil does almost alone, would cause a distribution of the pressure over the greater part of two surfaces instead of over one. But the method of pinning them and breaking the joints, really spreads the pressure over a great number of them, and that without any great strain upon the pegs, for the friction of the sub-earth beneath helps much to diminish this strain in the way we have before alluded to. Hence by dividing the pressure over a large range of the blocks longitudinally, the co-operating aid of an equal number on each side of this row is called into action by means of the pegging system, and the individual pressure, therefore, is much extenuated, as well as the strain on the pegs. Indeed the whole body has somewhat the property of a solid, every part being united to the other by the manner of breaking the joints by contra-running rows, and pinning them together. It is thus, in a great measure, independent of unequal hardness of subsoil, and must preserve, much better than the other method can, a more even surface.

In the hexagonal blocks the grain is perpendicular to the road; in these it is parallel to the sides of the blocks, and therefore somewhat oblique to the road; it is said this has been found preferable, and that horses do not slip so much on this sort of road as they do upon the other blocks. If this be the case, it is a curious and highly advantageous property, of which, however, we do not see any physical reason. We have, at different times, paid some attention to this, and certainly have observed, or fancied we have, much less slipping upon the specimens laid down after this plan than after the other plans. This, however, may be in part occasioned by a groove cut longitudinally along the blocks; and, if so, another groove cut transversely would be a still farther safeguard against slipping.

It may be supposed that there would be some difficulty in shaping these blocks, but there is really none. The blocks are cut in long square lengths in the direction of the grain, and the figure is given at once, without waste, by cutting them off in the proper oblique angle. The joints are of course, therefore, between the blocks, far more perfect than it is almost possible they can, by any expense, be made in the hexagonal shape.

Our readers will thus see that the great advantages of this plan consist in accomplishing, by a simple and easy cut figure in the blocks, and proper pinning, a greater uniformity and distribution of bearing, a much more even surface, and consequently a less wear and tear, and less annual expense in keeping the road up. We have heard that so conscious of superiority in the diminished wear are the parties connected with the undertaking, that they decline laying down a pavement unless they also are permitted to contract for the keeping of it in repair.

The patent is now in the hands of a company, and it seems by the interest excited in its favour, that ere long it will become almost the sole and only plan of wood paving, not only throughout London—which there is little doubt will, in a few years, be nearly all paved with wood—but in other large towns of the United Kingdom. We have just heard that an order for one-quarter of a mile of this plan has been given for the town of Manchester.

Our intention was, in the present number, to compare the expense of this sort of pavement with others, for which we have collected some materials, but we find we must defer it to our next. Railway Mag.

Wood Pavements.

In the wood pavings, the exceeding small wear has been a feature as remarkable as it was unexpected. We all anticipated that the surface of so soft a body as deal would never have stood the heavy weights it appears it does at so insignificant a cost of repair. The general opinion was, that the surface would wear into holes, and quickly give way; on the contrary, the wood has worn with great evenness, and wherever the subsoil has been good, the surface has continued nearly as uniform as it was laid. It is, however, next to impossible to obtain a bottom equally hard in every part, and in that case if the blocks are not pinned together—and pinned in such a manner as to give the least possible strain on the pins—the inevitable consequence must be a subsiding of those where the substratum is less hard, followed by a rough uneven surface. Instances of this kind have occurred in the Old Bailey, and May Hill, leading into Berkeley Square, which were laid with hexagonal blocks. The former, we understand, have been taken up and relaid, and the same is now doing with the latter, which are evident proofs of the system on which they were laid being bad.

The great failing feature in the hexagonal blocks is, besides the want of pins and proper dependence one on the other, the clumsiness of the joints. The blocks, we believe, are hewn into shape, as sawing them truly would probably be too expensive. On this account, the joints are open and filled with dirt, which, in wet weather, is constantly working up, and rendering the surface so unpleasantly slippery. An evident proof of this is in the Strand, where the blocks have all been obliged to be cobbled and repaired before they had been laid down a week. This fault is avoided in the Metropolitan Company's, by having the sides square and parallel to each other, which admit a close joint, and keep out the offending matter.

In the plan of the Company, this Metropolitan Patent Wood, of which we spoke in our last, we understand the wooden blocks are laid on concrete floorings, to give still further advantages to their form and method of pinning. A greater expense is thus incurred at first, but it tells in the end. Thus, for instance, the Company offer to keep their pavement in repair, with the traveling in Oxford street, for 2s. 6d. per square yard per annum, while, under the plan of a Macadamised road, we understand the cleansing alone amounts to £1,400 per annum, or near 1s. per square yard, and the annual repairs to £5,000, or 3s. 6d. per square yard more, making in all 4s. 6d., or nearly double that of the proffered offer to keep the wood in repair.

Again, as to the first outlay. The price proposed to be charged by the above Company is somewhere about 12s. 6d. or 13s. per square yard for laying the pavement with the concrete flooring complete. Compared with the other wood, the hexagonal, which was, we hear, 9s., we confess we thought this high, though it was low in comparison with the advertised price, 14s., of the Imperial, and not a half of what we hear that by Saint Clement's church cost, that is 32s. But it is not the first cost which is the test of expense. Durability is a far more important object. One pavement might be dear at 9s., while another would be cheap at £1. If, for instance, a pavement could be laid at 9s. which would last a year, it would be much cheaper to give £1 for one that would last five years. And if we add the consideration of the inconvenience to the inhabitants, and loss in trade to them, by having their streets every now and then broken up, and their

business for the time interrupted and almost totally suspended, the first cost, to have a durable pavement, sinks into insignificance. But the first cost in wood is trifling compared to that of stone. We have been informed that an estimate to the vestry of St. Marylebone to pave the whole of Oxford street, about 30,000 square yards, with smooth granite, was for £28,000, or near 19s. per square yard, that is about £8,500, or 44 per cent. higher than the price of wood. If tooled granite were used, it probably could not be done under 32s. per square yard, or £48,000; that is no less than 147 per cent. higher. Rough stone might, perhaps, be laid down for £23,000, or about 15s. per yard, but every one knows this would never answer in a street of great traffic.

What is the first cost of Macadamising with granite we have not learnt, but we believe it is much higher than that of the Metropolitan Patent Wood, described in our last number, and the annual expense afterwards is awful. For instance, Blackfriars bridge, which costs £1,000 annually, to keep in repair as a Macadamised road, cost only £120 per annum when paved with stone. One great objection to Macadamised roads too, is the rough, unpleasant state of them when first laid, and another the intolerable dirt and dust of them afterwards, exclusive of noise. Wood is not only less expensive in its first cost, but incomparably so in its subsequent annual maintenance. It has also the great advantage of being in a perfect state when first laid, and, if the plan of the Metropolitan Company is adopted, of maintaining a smooth surface, and not wearing unevenly or sinking into holes, as long as the material lasts, which, if Kyanized, may be very many years.

Now those who have experience in these matters assert that nothing but tooled granite laid in concrete will, in point of wear, compete with good wood pavement, and from what we have seen in Oxford street, this does appear to be the case. If so, there can be no doubt of the great superiority of wood, and that the entire of the capital will, before long, be paved with it; for the very annual saving would, in a short time, amount to the cost of relaying with wood. In Oxford street, under 2½ years cost of repairs would do it, while in the mean time they would enjoy all the advantages of a 2½ years earlier cessation of that noise, dust, and dirt, which it is the object of wood to avoid.

Railway Mag

Engineers and their Estimates.

We last week slightly touched on the unfortunate errors of engineers in estimating the cost of railways. Had not the subject been brought under our notice, it is not probable we should have alluded to it. It is, however, one of those crying evils which call loudly for redress. Mr. Herapath, in No. 18, vol. i., p. 419, has defended the conduct of engineers, on account of the haste with which they are obliged to rush into railway projects, and to execute them; but however just his observations, and whatever might have been the excuse in the early state of railway enterprise, and when the railway fever was raging, there can be none now. Sufficient experience has been had to make their estimates correctly, or it never will.

Happily railways have all turned out much more fertile in traffic than was ever anticipated, and so far have been favourable to engineers; but still the profits have fallen short on account of the great excess of the cost over the estimates. Had the lines been executed for any thing like the estimates, there is probably not one in the kingdom but would have returned a handsome dividend. But unfortunately the outlay has so enormously

outstripped all expectations, that the returns, though much greater than could ever have been hoped for, have in a few instances been unequal to pay the interest on capital. We shall here give the capital and cost, as far as our knowledge extends, of twenty of the finished railways in the order in which the original acts were obtained.

Names.	Estimate.	Cost.	Royal Asssent.	Capital at Cost.
	£	£		
Ballochney, . .	18,431	38,431	May, 1826	2.09
Dundee and Newtyle,	30,000	170,000	Do.	5.67
Edinburgh and Dalkeith,	70,125	133,053	Do.	1.90
Glasgow and Garnkirk,	28,479	148,195	Do.	5.12
Liverpool & Manchester,	510,000	1,465,000	Do.	2.88
Clarence, . .	100,000	500,000	May, 1828	3.00
Newcastle and Carlisle,	300,000	750,000	May, 1829	2.50
Leeds and Selby, .	210,000	340,000	May, 1830	1.62
Leicester & Swannington,	90,000	175,000	Do.	1.94
Manchester and Bolton,	204,000	650,000	Aug. 1831	3.19
Belfast and Cavehill,	7,500	38,700	Apr. 1832	5.15
London and Birmingham,	2,500,000	5,500,000	May, 1833	2.20
London and Greenwich,	400,000	733,333	Do.	1.83
Grand Junction, .	1,040,000	1,906,000	Do.	1.84
Whitby and Pickering,	80,000	135,000	Do.	1.69
Durham Junction, .	80,000	130,000	June, 1834	1.63
South-western, .	1,000,000	1,860,000	July, —	1.86
Durham and Sunderland,	102,000	256,000	Aug. —	2.51
London and Croydon,	140,000	575,000	June, 1835	4.12
Brandling Junction,	110,000	336,000	Do. 1836	3.05
			Mean,	2.79

Here is contained a lamentable picture of the sad failures of engineers in precalculating the cost of their works. The nearest approximation to truth is 62 per cent. on the estimates; but the other cases present errors varying up to 467 per cent., the mean error being 180. Now with all the indulgence which may be claimed on the score of novelty, or other circumstances, it does seem difficult to defend such errors as these. However, there are causes, which Mr. Herapath has enumerated in the article alluded to, serving to explain a great portion of them, but not entirely to exculpate engineers. But as these causes no longer exist, there can be no excuse in future for insufficient estimates. We do, therefore, hope hereafter to see the cost of railways calculated with much greater precision. We cannot see why they should not be computed within 10 or 15 per cent. of the truth, as well as any other works. At all events, it will be expected; and we apprehend the man who does not do it must not expect to have a second opportunity of abusing the confidence of the public.

This table affords one or two curious facts relative to what may be called the statistics of railway estimates. For instance, the average estimate is 2.79 times the capital, or 179 per cent. more. So that, taking the estimates as usually made, we must multiply them in round numbers by $2\frac{3}{4}$ to give the cost.

Again, it appears that railways in which the per centage errors have been the greatest, are the small ones, as for instance the Dundee and Newtyle, capital £30,000; the Glasgow and Garnkirk, capital £28,479; and the Belfast and Cavehill, capital £7,500. Those in which the per centage cost has been the least, have been two of £80,000 each, and one of £210,000. There is not a single instance of the cost exceeding the estimate above the average per centage, when the capital exceeds only £120,000, except the Manchester and Liverpool, the Manchester and Bolton, and the London and Croydon Railways. This, therefore, is decidedly against the evidence given by Mr. Robert Stephenson, namely, that the greater the length of line, and of course of the estimate, the greater the difficulty of computing the cost, and the greater the proportional error. In fact, it seems contrary to reason that it should be so. The least reflection would tell us that the greater the scope the greater the probability of a balance of errors, if the estimator possessed any skill at all. We have a proof of this in the London and Greenwich, the Grand Junction, and the South-western, in which the per centage excesses of cost are respectively, 83, 84, and 86 each, not a half the average per cent. excess.

With regard to the main question, of whether engineers have gained any thing by their experience, it is difficult to determine much from the foregoing synopsis. Excluding the last three, as railways of small capital, it would appear that engineers have improved a little, and that instead of blunders of 180 per cent., they have reduced them to something under 100 per cent. in the latter cases, which we must own looks like doing better—like having gained something by their experience. If they go on progressing thus, it is possible that in another half century engineers' estimates will come to something near the mark.

The public, however, cannot wait for such slow marches. It thinks that engineers have had sufficient time and experience to learn to make estimates with more accuracy. This has been shown by the reluctance of the public to enter into any new railway speculations. There is no lack of confidence in railway investments, nor any doubt of the traffic equalling and exceeding all reasonable calculations. The objection is to the great uncertainty of the cost. Engineers, therefore, are only doing themselves and the public an injury in not taking some efficient measures to revive public confidence. The only plan appears to us to be, not to be hurried into hasty conclusions, but maturely to examine all the points, and when they have satisfied themselves, to give such an estimate as they know will fairly cover the entire cost, and to bind themselves to execute it for the sum. When the public sees this confidence in their own skill and judgment, it will be induced to go on with these speculations, and to prefer them as investments; but, we apprehend, not before.

Ibid.

Atmospheric Railway.

[Some account of the principles on which this ingenious mode of propelling cars on railways was intended to operate, was given in Jour. Frank. Inst. vol. xxiv. p. 210. The following is a detailed statement of the plan and results as actually in practice on a portion of the Junction railway between Birmingham and Bristol. G.]

We attended on Thursday, the 11th ult., at Wormholt Scrubbs, to witness an experiment on a portion of the Birmingham, Bristol and Thames

Junction Railway, which had been laid down by Messrs Clegg & Samuda, on their patent atmospheric principle; as might have been expected, the practical introduction of a system so different from that now in use on other railways, excited considerable interest.

The idea of employing the power of the atmosphere, against a vacuum created in an extended pipe, laid between rails, and communicating the moving power thus obtained to propel carriages traveling on a road, we believe originated with Mr. Medhurst, who laid before the public details of his plan in a work he published in 1827, entitled "A New System of Inland Conveyance;" indeed so far back as 1812 he published some ideas on this method of Locomotion. About 1835 some experiments were made with a model on Wigmore street, by Mr. Pinkus, very similar to those described by Mr. Medhurst; these experiments, however, failed, from the same causes which probably prevented Mr. Medhurst from carrying his into effect, viz., the impossibility of making the continuous communication from the inside of the pipe to the carriage tight enough to allow a useful degree of rarefaction to be produced. Messrs Clegg & Samuda's invention overcomes this difficulty in a very simple manner; indeed the constructing and closing this continuous valve, by *hermetically sealing it up with a composition* each time a train passes, forms the main feature in their invention.

The portion of the line selected on which the experiments were made is half a mile long, with a rise of 1 in 120 for rather more than half the distance, and 1 in 115 for the remainder. A continuous cast iron pipe or tube 9 inches in diameter, is fixed between the rails, and bolted to the sleepers which carry the rail chairs; the inside of this pipe, which is unbored, is lined with a strong lubrication of pressed tallow about $\frac{1}{10}$ of an inch thick, which equalizes the surface, and prevents any unnecessary friction from the passage of the traveling piston through it; along the upper surface of the pipe is a continuous slit or groove about $1\frac{1}{2}$ inch wide. This groove is covered by a valve extended the whole length of the railway, formed of a strip of leather riveted between iron plates, the top plates being wider than the groove, and serving to prevent the external air forcing the leather into the pipe when the vacuum is formed within it, and the lower plates fitting into the groove when the valve is shut, makes up the circle of the pipe, and prevents the air entering the tube; one edge of this valve is securely held down by iron bars fastened by screw bolts to a longitudinal rib cast on the pipes, and thus allows the leather between the plates and the bar to act as a hinge, similar to common pump valves; the other edge of the valve falls into a groove which contains a composition of bees-wax and tallow; this composition is solid at the temperature of the atmosphere, and becomes fluid when heated a few degrees above it. Over this valve is a protecting cover, which serves to protect it from snow or rain, formed of thin plates of iron about 5 feet long, hinged with leather, and the end of each plate underlaps the end of the next in the direction of the piston's motion, thus insuring the lifting of each in succession. To the underside of the first carriage in each train is attached the piston and its appurtenances; about six feet behind the piston, the horizontal piston-rod is attached to a connecting arm which passes through the continuous groove in the pipe, and being fixed to the carriage, imparts motion to the train as the tube becomes exhausted of the air; attached to the piston rod, and preceding the connecting arm, two steel wheels are fixed, which serve to lift the valve to allow the connecting arm to pass, and also for the atmosphe-

ric air to impinge immediately on the back of the piston; another steel wheel, which is attached to the carriage by a spring, serves to ensure the closing of the valve, by running over it immediately after the piston has passed, in case it should not fall by its own weight. A copper tube about 10 feet long, which is constantly kept hot by a small stove, also fixed to the under side of the carriage, passes over the surface of the composition (which has been broken up by lifting the valve out of it,) and rendering it fluid, which, upon again cooling, becomes solid and hermetically seals the valve. Thus, each train, in passing, leaves the pipe and valve in a fit state to receive the next train.

For the purpose of exhausting the tube a steam engine of 16 horse power is employed, which works an air-pump or exhauster $37\frac{1}{2}$ inches diameter, and $22\frac{1}{2}$ inches stroke, making from 40 to 43 strokes per minute. The air-pump is connected with the exhaust tube in the centre of the railway, by means of a branch pipe 9 inches diameter leading from the air-pump.

To calculate the power of this kind of apparatus, it is necessary to ascertain the state of vacuum and the difference of the pressure of the atmosphere which forces the piston forward; in the present experiments the vacuum was equivalent to from 18 to 20 inches of mercury, which will give for the useful pressure of the atmosphere on the piston about 9lb. on the square inch. The area of the tube, 9 inches diameter, is equal to 63.62 square inches, and this multiplied by the pressure will give

$$9 \times 63.62 = 572.58 \text{ lbs.}$$

for the pressure on the back of the piston, or the moving power.

The load conveyed at each experiment may be taken as follow:—

Two carriages........................	=	4 tons.
Apparatus attached..............	=	1 ton.
Forty-five passengers................	=	3 tons.
Total load conveyed............	=	8 tons.

The stationary engines and air-pumps on this system may be fixed in distances varying from one to four miles apart, to suit the traffic and convenience of the line of road; each section or length of pipe acted on by one engine is confined by two valves; the vacuum is created to about 18 to 20 inches of mercury before the piston enters the pipe, and is maintained during the passing of the train by the engine being kept at work; having passed through one section of pipe, the momentum the train has obtained, serves to carry it on to the next section, which commences at about 100 or 200 yards beyond, and the entrance separating valve of the second section being opened by the carriage immediately after it has entered, allows the vacuum prepared in this section to act upon the piston; thus the train can pass from section to section without end, and without any stoppage.

Experiments.—For the purpose of ascertaining the relative velocity on various portions of the half mile, it was divided into twenty sections of 2 chains or 44 yards each. The carriages were started from a state of rest at the foot of the inclined plane of one in 120, and allowed to run up the incline of half a mile before the break was applied to arrest the progress of the carriages. When two carriages were attached, they run over the ground, after passing the first five divisions at the velocity of 7, 6, 5, and 4 seconds to each section, which is equivalent to 13, 15, 18, and $22\frac{1}{2}$ miles per hour; and when *one* carriage only was attached, it run over the

ground at the velocities of 6, 5, 4, and 3 seconds to each division, which is equivalent to 15, 18, $22\frac{1}{2}$, and 30 miles per hour. The last division in each experiment was done at the greatest velocity, which clearly shows that had the experiment been made on a mile run instead of a half mile, the experiment would have been far more favourable and satisfactory; and if the experiment had been made on a level, about four times the above load might have been conveyed at the same velocity.

We noticed that it took about $1\frac{1}{2}$ minutes to raise the vacuum each trip, to about 18 inches of mercury.

From the above experiments, the loads drawn, and the speed attained, will be as good a criterion of the success of the undertaking as we can have, and when we consider that in producing these results, the patentees must have been wholly unassisted by any previous examples, we think that the greatest credit is due to the talent and ingenuity they have displayed. The system appears to us to possess many advantages which must insure it the serious consideration of the engineer. The carriages travel without noise, and without the risk of explosion, or of getting off the rail. It does not seem possible that a collision of trains can take place, for two trains cannot receive power from the same section of pipe at the same time, neither can they receive power in opposite directions on the same rail. The speed on this system must be proportioned to the capacity of the air-pumps used to maintain the exhaustion in the tubes, and therefore any rate of traveling that may be deemed desirable may be easily attained.

Civ. Eng. Arch. Jour.

Atmospheric Railway.

Monday some experiments were made, at which we were again present, in addition to the public set recorded in our last; but owing to the state of the boiler they added very little information to that acquired from the previous Thursday's experiments. In a couple of trips we attained velocities of 30, or very nearly 30 miles an hour. Had the machinery been in order, and the main tube of a sufficient size, there seems little doubt but that a very high velocity might have been reached.

In the trip principally alluded to, which was the fourth we were present at that day, there was one carriage of $3\frac{3}{4}$ ton, carrying 14 persons, and the column of mercury exhausted was from $15\frac{1}{2}$ to 16 inches, but the number of strokes of the engine per minute was by some means not recorded.

As the incline was sufficiently great (44 feet per mile) for the carriage to descend by its own gravity, some experiments were made to ascertain what velocity it would attain, and it was found that, however loaded, the greatest uniform velocity was about 9 miles an hour. Sometimes the two-chain distances were run over in 9 seconds, and sometimes in 11, but usually in 10, which gave exactly 9 miles an hour. Now the weight of our carriage was estimated to be $3\frac{3}{4}$ tons, and if we suppose there was a ton weight of persons in it, the gravitation down the incline was $18\frac{1}{3}$ lbs per ton, or

$$\frac{4\frac{3}{4}\times 2240}{200}=4\tfrac{3}{4}\times 18\tfrac{1}{3}=\text{about } 86\ 5\text{-6ths lbs. in all.}$$ And by measuring it we found the front surface of the carriage, including the frame, was about 48 square feet, but including the wheels and bodies of the individuals probably not less than 70. By our table, vol. 1 of the octavo series, the resistance

of the atmosphere, per square foot, at 9 miles an hour is .31 lb. and therefore on 70 feet $21\frac{3}{4}$ lbs. nearly. Taking this out of 86 5-6ths leaves about 65 lbs. for the resistance of the road, or 13.7 lbs. per ton, or in round numbers 14, which, under the circumstances of the carriage, bad rails, and curved road, is probably nearer the mark. This would considerably reduce the apparent loss of power alluded to in our last.

Our readers will perceive that the great points in this invention are the obtaining of a sufficient exhaustion in the main tube to draw the weight by the excess of the atmospheric above the rarified pressure; and afterwards the keeping up of this exhaustion, according to the rate wanted to be traveled. We saw by the experiment recorded in our last that an exhaustion of 19 inches of mercury out of 29 or 30 inches had been made, on a half mile of tube 9 inches diameter, and maintained, while the carriage was traveling, notwithstanding leakage. We might therefore fairly conclude that under similar circumstances, with an engine of 4 times the power, and an air pump of twice the diameter, a main of twice the diameter and 4 times the length, or two miles, might have been better exhausted, and the exhaustion better maintained, with 4 times the load traveling at the same rate. For the leakages upon two miles being 4 times as great, and into a body of air 16 times the bulk, their effect would have been only one-fourth as much, which therefore we think might fairly be set against the extra friction of the air passing through a quadruple length.

Assuming this to be true it becomes a question of first cost and expense afterwards, how far the atmospheric plan is equal, or preferable, to the locomotive. The first cost consists chiefly in the fixed engines, which must be, at farthest, every two miles, and the laying down of the mains, as against the cost of a stock of locomotives, and any saving which might be made in cuttings and embankments. To the credit of the atmospheric plan must also be set that of having rails not exceeding half the weight of the present. With regard to the wear and tear there is no doubt that of the road would be considerably in favor of the atmospheric railway. But the maintenance of the mains and attendance upon them, to see that they are air-tight, are items which can only be satisfactorily answered by an appeal to experience. The total duty of the fixed engines will doubtless much exceed that of the locomotives, though the wear and tear will probably not be so great.

With regard, however, to the cost or subsequent expenses, we have not gone into any calculations, but supposing the atmospheric railway brought to perfection, and that the expenses are at all equal to that by the other, there can be no question as to its comfort and superiority over railway traveling by locomotives. Indeed to do away with the locomotives is now the chief *desideratum*, for they are the heavy drawbacks, both in comfort and security, to a system of traveling otherwise as much superior in pleasure and comfort to all others as it is in speed. Railway Mag.

LUNAR OCCULTATIONS FOR PHILADELPHIA, NOVEMBER, 1840.					Angles reckoned to the right, or westward, round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
2	6	28	Im. ι Capricorni,	5	139°	140°
2	7	50	Em.		291	310
3	7	17	Im. *e* Aquarii,	6	117	118
3	8	37	Em.		321	342
5	11	8	N. app. ☽ & 21 Piscium 6, ☽ North 1′.8			
7	13	38	Im. 101 Piscium,	4	149	199
7	14	34	Em.		261	313
9	17	51	Im. *g* Pleiadum,	5,6	21	75
9	18	6	Em.		351	45
9	17	44	Im. *e* Pleiadum,	5	75	129
9	18	35	Em.		297	348
9	18	7	Im. *m* Pleiadum,	7	176	230
9	18	15	Em.		194	247
9	18	4	Im. *c* Pleiadum,	5	46	100
9	18	39	Em.		324	15
10	5	1	Im. χ Tauri,	6	91	48
10	5	46	Em.		297	249
11	14	44	Im. *C* Tauri,	4,5	132	157
11	15	37	Em.		218	267
16	15	56	N. App. ☽ & 0′ Sextantis 6, ☽ South 0.′3			
17	18	36	Im. *v* Leonis	4,5	46	29
17	19	57	Em.		232	237
28	7	17	N. App. ☽ & 4 Capricorni 6, ☽ S. 1′.0			

Meteorological Observations for June, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	62	86	29.73	29.72	S.W.	Moderate.		Clear—do.
	2	54	57	.85	.90	E.	do.		Cloudy—do.
	3	65	68	.80	.72	S.	do.		Drizzle—rain.
	4	65	65	.56	.54	S.E.W.	Calm.	3.44	Fog—rain.
	5	61	78	.56	.66	W	do.		Clear—flying clouds.
☾	6	61	81	.73	.74	N.W.	Moderate.		Lightly cloudy.—do. do.
	7	67	64	.70	.80	S.W.N.W	do.	.93	Rain—cloudy.
	8	48	68	30 02	30 06	W.	Calm.		Clear—flying clouds.
	9	54	70	.08	.02	W.N.	do.		Clear—do.
	10	59	81	.13	.13	S.W N.E.	Moderate.		Light clouds—do.
	11	64	85	.02	29.97	W.	do.		Lightly cloudy—clear.
	12	67	89	29.83	.83	W.	do.		Clear—do.
	13	71	85	.70	.76	W.	do.		Lightly cloudy—do.
☉	14	62	80	.87	.87	W.	do.		Clear—do.
	15	65	69	.81	.83	W.E.	do.	.15	Rain—cloudy.
	16	56	80	.96	.94	N.	do.		Clear—do.
	17	56	80	30.00	30.00	W.	Calm.		Clear—do.
	18	59	65	29.99	29.85	W.	do.	.30	Lightly cloudy—rain.
	19	56	74	.72	.69	N	Brisk.		Clear—flying clouds.
	20	59	68	.61	.61	S.W.	do.		Clear—flying clouds.
	21	58	81	.71	.74	W.	Moderate.		Clear—do.
☽	22	61	84	.73	.73	S.W.	Calm.		Partially cloudy—do.
	23	67	84	.91	30.00	N.W	do.		Cloudy—do.
	24	64	88	30 00	29.96	S W.	Moderate.		Clear—flying clouds
	25	67	89	29.83	.80	W E.	Calm.		Clear—do.
	26	65	67	.76	.84	N.E E	Brisk.	.14	Cloudy—rain.
	27	62	79	.84	.81	N.E.	do.		Cloudy—flying clouds
⊗	28	68	83	.80	.80	W.	Calm.		Cloudy—flying clouds.
	29	71	87	.80	.81	S W	do.		Cloudy—flying clouds.
	30	69	88	.75	.75	S.W.	do.		Partially cloudy—flying clouds.
	Mean	62.10	77.47	29.83	29.83			4.96	

	Thermometer.		Barometer.
Maximum height during the month.	82.00	on 12th.	30.13 on the 10th.
Minimum " "	48 00	on 8th.	29.54 " 4th.
Mean	69 785		29.83

Co

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53

								Hygrometer.					
S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
11⅔	2	.	⅓	11⅓	.	⅓	.	....	.	.....	....	.	1018
5⅔	⅓	5	1	3	.	.	.	....	.	.....	....	.	1015
3⅓	2	7	.	2⅓	.	.	5⅔	....	.	.....	....	.	1004
3⅔	.	3	.	7	.	6⅔	.	....	.	.....	....	.	1216
3⅓	1	3⅓	1⅓	7	.	2	1⅔	39.95	9	.....	....	.	1008
1	2⅓	3	2⅓	3	2⅓	.	4⅓	38.01	13	.....	47.67	13	999
⅓	.	2⅔	.	6⅓	.	3⅔	.	....	.	.....	48.62	1	996
2⅔	.	2⅓	.	9	.	8⅓	2	....	.	.....	....	.	997
3	⅔	5	1⅔	5	.	5⅔	.	....	.	.....	....	.	1012
2	1	5	1	3⅓	⅔	5	.	....	.	.....	....	.	1014
.	.	21	.	.	.	.	.	....	.	.....	....	.	1042
8	.	2⅔	.	10	.	.	2	....	.	.....	....	.	1090
7	.	2⅓	.	12	.	⅓	3⅓	....	.	.....	46.12	7	1023
4	.	11	⅓	5⅓	.	3⅓	1⅓	....	.	.....	...	.	1002
1⅔	3⅓	2⅓	5⅔	3⅓	1⅓	.	.	....	.	.. .	....	.	998
6	3⅓	3⅓	2⅔	3⅔	⅓	7⅔	⅔	....	.	.....	....	.	1044
5⅓	.	8⅓	.	3⅔	.	10	.	....	.	...	....	.	1057
4	⅓	.	1	3⅓	.	15⅓	6⅔	....	.	.... .	....	.	1017
..	.	7⅓	.	⅓	.	16	1⅔	....	.	....	....	.	1009
2⅓	.	.	.	6	.	.	20⅔	....	.	.....	....	.	1003
11	.	2	.	13	.	.	.	....	.	.....	....		1047
8	.	9⅔	.	3	.	.	.	....	.	.....	....	.	1001
3	⅔	3⅓	2	5⅓	1	.	9	....	.	.....	....	.	1000
1⅔	1⅔	6⅓	2⅔	2	1⅓	3⅔	.	....	.	.....	....	.	1010

METEOROLOGICAL REPORT
FOR THE STATE OF PENNSYLVANIA,
Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

MARCH, 1840.

No.	County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.
1	Philadelphia,												
2	Montgomery,												
3	Bucks,	Newtown,	L. H. Parsons,	37.90	50.11	39.68	70.25	19.00	42.56	.	16.00	32.68	.
4	Lehigh,												
5	Northampton,	Easton,	Lafayette College,	34.55	45.29	38.81	68.00	15.00	39.55	.	....	....	.
6	Monroe,	Stroudsburg,	A. M. Stokes,	35.93	48.76	38.23	75.00	16.00	40.97	8⅓	....	....	.
7	Pike,												
8	Wayne,												
9	Susquehanna,	Silver Lake,	E. W. Rose,	28.06	39.97	33.19	64.00	8.00	33.74	.	6.00	26.77	.
10	Luzerne,	Wilkesbarre,	W. F. Dennis,										
11	Schuylkill,												
12	Berks,	Reading,	C. F. Egelmann,										
13	Chester,												
14	Delaware,	Haverford,	Haverford School,	39.63	52.32	42.35	72.00	18.00	44.10	5	18.00	36.58	.
15	Lancaster,	Lancaster,	Conservatory of Arts,	39.33	54.61	43.07	75.00	20.50	45.67	4	19.00	36.26	2
16	York,												
17	Lebanon,												
18	Dauphin,												
19	Northumberland,	Northumberland,	Andrew C. Huston,	39.53	48.45	40.63	69.00	20.50	42.87	.	17.00	33.00	.
20	Columbia,												
21	Bradford,												
22	Tioga,												
23	Lycoming,												
24	Union,												
25	Mifflin,												
26	Juniata,	Mifflintown,	J. A. Rinkead,	36.63	50.88	42.82	75.00	11.00	42.82	2	....	....	.
27	Perry,												
28	Cumberland,	Carlisle,	Prof. W. H. Allen,	37.13	49.55	40.71	68.00	16.00	42.46	.	14.00	34.10	.
29	Adams,	Gettysburg,	Prof. M. Jacobs,	38.14	51.82	42.61	71.50	18.00	44.19	.	17.00	36.00	.
30	Franklin,												
31	Huntingdon,	Huntingdon,	Jacob Miller,	38.06	54.21	41.10	76.00	20.00	44.46	.	15.00	41.10	15
32	Centre,	Bellefonte,	John Harris,	33.45	42.93	37.70	70.00	13.00	40.03	2	10.00	30.10	2
33	Potter,												
34	M'Kean,	Smithport,	Richard Chadwick,	31.10	43.45	32.27	64.00	10.00	35.60	⅓	7.00	26.61	.
35	Clearfield,												
36	Cambria,	Ebensburgh,	Richard Lewis,	33.13	44.97	36.13	71.00	12.00	38.08	1	....	....	.
37	Bedford,	Bedford,	Samuel Brown,	39.45	52.45	43.57	76.20	18.00	45.16	.	....	....	.
38	Somerset,	Somerset,	George Mowry,	37.97	46.50	39.97	66.00	20.00	41.49	⅔	18.00	30.85	21
39	Indiana,	Indiana,	Richard White,	40.84	50.20	38.29	73.00	16.00	43.11	.	....	....	.
40	Jefferson,	Rose Cottage,	C. C. Gaskell,	31.31	46.22	33.92	70.00	9.00	37.15	5⅓	....	....	.
41	Warren,	Warren,	R. Brown,	34.18	47.56	33.76	68.00	11.50	38.50	1⅔	....	....	.
42	Venango,	Franklin,	Wm. Connelly,	31.74	48.84	38.74	75.00	14.00	39.74	.	....	....	.
43	Armstrong,												
44	Westmoreland,												
45	Fayette,												
46	Green,												
47	Washington,	Cannonsburg,	Jno. H. Kennedy,	39.23	51.52	41.35	77.00	18.00	44.03	.	....	....	.
48	Allegheny,												
49	Beaver,												
50	Butler,	Butler,	Jacob Mechling,	34.29	46.53	39.10	75.00	15.00	39.97	.	....	....	.
51	Mercer,	West Greenville,	John Keck,										
52	Crawford,	Meadville,	J. Limber,	38.71	44.74	39.74	68.00	24.00	41.06	.	22.00	34.84	.
53	Erie,	Erie,	Park & Reid,	35.68	41.50	35.55	62.50	20.00	37.58	.	15.00	29.37	.

No.	County.	Barometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Weather. Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.
3	Bucks,	29.86	29.81	29.85	30.33	29.37	29.84	.	10⅔	19	1⅓	....	....	....	..	3.301
5	Northampton,	....	....	....	....	....	...	.	.	.	.	....	....	....	..	.....
6	Monroe,	29.36	29.34	29.35	29.80	29.00	29.33	6	6	17	8	....	....	....	..	.....
9	Susquehanna,	27.75	27.77	27.77	28.15	27.40	27.76	.	14⅓	16⅔	.	4	....	1	..	2.400
14	Delaware,	29.40	29.35	29.37	29.86	28.80	29.37	10⅓	5	10⅓	15⅔	....	....	....	..	2.128
15	Lancaster,	29.31	29.27	29.34	29.83	28.81	29.31	4	13	14	4	6	3	....	1	2.795
19	Northumberland,	29.27	29.23	29.31	29.97	28.76	29.27	.	8⅓	22⅔	.	6	5	3	1	6.481
26	Juniata,	29.34	29.30	29.32	29.93	28.80	29.32	2⅓	10⅔	16	4⅓	....	....	....	..	2.600
28	Cumberland,	29.18	29.19	29.18	29.69	28.63	29.19	.	11⅔	19⅓	.	...	5	....	3	2.117
29	Adams,	29.26	29.22	29.26	29.71	28.72	29.24	.	15⅓	15⅔	.	....	....	....	..	2.524
31	Huntingdon,	29.16	29.13	29.17	29.65	28.64	29.15	.	.	.	.	....	....	....	..	.....
32	Centre,	29.08	29.04	29.15	29.60	28.57	29.09	2	10	19	2	4	2	3	1	4.175
34	M'Kean,	28.02	27.90	27.96	28.32	27.38	27.96	.	9	21⅔	⅓	6	3	2	2	5.073
36	Cambria,	27.58	27.58	27.57	28.03	27.00	27.58	1⅓	8	20⅔	2⅓	4	4	....	2	....
37	Bedford,	29.00	29.02	29.05	29.92	28.08	29.02	.	15⅓	15⅔	.	5	3	....	1	.....
38	Somerset,	27.68	27.67	27.69	28.07	27.16	27.68	⅔	8	22⅓	⅔	7	6	....	1	1.857
39	Indiana,	28.42	28.43	28.45	28.90	27.90	28.43	.	13	16⅔	1⅓	....	....	....	..	.....
40	Jefferson,	28.71	28.72	28.67	29.80	28.30	28.70	6⅔	10⅓	13⅔	7	....	....	....	..	4.286
41	Warren,	28.60	28.64	28.63	29.10	28.15	28.62	1⅔	10⅓	18⅔	2	....	....	...	..	.....
42	Venango,	....	28.76	....	29.28	28.10	....	20⅔	4⅓	6	20⅔	....	....	....	..	.....
47	Washington,	28.87	28.86	28.87	29.35	28.25	28.87	.	10	21	.	....	....	....	..	3.598
50	Butler,	28.71	28.68	28.70	29.10	28.20	28.70	.	12	19	.	2	4	1	2	3.189
52	Crawford,	28.53	28.53	28.54	28.95	27.87	28.53	.	8⅔	22⅓	.	9	5	1	2	4.641
53	Erie,	29.28	29.28	29.28	29.75	28.60	29.28	.	10⅓	19⅔	1	....	....	....	..	3.780

No.	County.	Winds. North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
3	Bucks,	.	.	4⅓	⅓	.	.	.	⅓	.	⅓	11⅔	2	.	⅓	11⅓	.	⅓	.	....	.	.....	....	.	1018
5	Northampton,	3⅓	.	4	.	3	.	4⅔	.	1	.	5⅔	⅓	5	1	3	.	.	.	....	.	.....	....	.	1015
6	Monroe,	2⅓	.	1	.	7	.	.	.	⅓	.	3⅓	2	7	.	2⅓	.	.	5⅔	....	.	.....	....	.	1004
9	Susquehanna,	2⅓	.	⅔	.	1	.	4⅔	.	2	.	3⅔	.	3	.	7	.	6⅔	.	....	.	.....	....	.	1216
14	Delaware,	2	⅔	2⅓	⅓	1	⅓	⅔	.	2⅓	1⅓	3⅓	1	3⅓	1⅓	7	.	2	1⅔	39.95	9	.....	....	.	1008
15	Lancaster,	2	.	2	⅔	1⅓	.	1	1⅔	⅔	3⅓	1	2⅓	3	2⅓	3	2⅓	.	4⅓	38.01	13	.....	47.67	13	999
19	Northumberland,	5	.	.	.	2	.	1⅓	⅓	9⅓	.	⅓	.	2⅔	.	6⅓	.	3⅔	.	....	.	.....	48.62	1	996
26	Juniata,	.	.	2⅔	.	1⅓	.	2⅔	.	.	.	2⅔	.	2⅓	.	9	.	8⅓	2	....	.	.....	....	.	997
28	Cumberland,	2⅓	⅓	1⅔	.	1⅔	.	2⅓	.	1⅔	.	3	⅔	5	1⅔	5	.	5⅔	.	....	.	.....	....	.	1012
29	Adams,	3⅓	.	2	.	.	.	.	.	6	1⅔	2	1	5	1	3⅓	⅔	5	.	....	.	.....	....	.	1014
31	Huntingdon,	.	.	.	.	10	.	.	.	.	.	.	.	21	.	.	.	.	.	....	.	.....	....	.	1042
32	Centre,	1⅔	.	1	.	⅓	.	3⅓	⅓	1⅔	.	8	.	2⅔	.	10	.	.	2	....	.	.....	....	.	1090
34	M'Kean,	1	.	.	.	3⅓	.	1	.	⅔	.	7	.	2⅓	.	12	.	⅓	3⅓	....	.	.....	46.12	7	1023
36	Cambria,	1⅔	.	⅓	.	⅓	.	1⅓	.	2	.	4	.	11	⅓	5⅓	.	3⅓	1⅓	....	.	.....	...	.	[illegible]
37	Bedford,	.	.	.	.	.	.	.	6	⅓	5⅔	1⅔	3⅓	2⅓	5⅔	3⅓	1⅓	.	.	....	.	.....	....	.	998
38	Somerset,	⅔	.	⅓	.	⅓	.	2	.	1	.	6	3⅔	3⅓	2⅔	3⅔	⅓	7⅔	⅓	....	.	.....	....	.	1044
39	Indiana,	.	.	.	.	1	.	⅔	.	1⅔	.	5⅓	.	8⅓	.	3⅔	.	10	.	....	.	.....	....	.	1057
40	Jefferson,	.	.	.	.	.	.	⅓	.	.	.	4	⅓	.	1	3⅓	.	15⅓	6⅔	....	.	.....	....	.	1017
41	Warren,	3⅔	.	⅓	.	⅓	.	.	.	1⅓	.	.	.	7⅓	.	⅓	.	16	1⅔	....	.	.....	....	.	1009
42	Venango,	.	.	.	.	.	.	2	.	.	.	2⅓	.	.	.	6	.	.	20⅔	....	.	.....	....	.	1003
47	Washington,	.	.	3	.	.	.	2	.	.	.	11	.	2	.	13	.	.	.	....	.	.....	....		1047
50	Butler,	.	.	1⅔	.	7⅔	.	1	.	.	.	8	.	9⅔	.	3	.	.	.	....	.	.....	....	.	1001
52	Crawford,	2	.	⅔	.	.	.	2⅓	⅔	⅔	.	3	⅔	3⅓	2	5⅓	1	.	9	....	.	.....	....	.	1000
53	Erie,	1	⅔	4	⅔	1	.	⅓	1	2	1	1⅔	1⅔	6⅓	2⅔	2	1	3⅔	.	....	.	.....	....	.	[illegible]

	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
2	7⅔	.	⅔	.	12	.	.	⅓	....	.	.....	....	.	982
	3	.	.	.	1	.	.	.	....	.	.....	....	.	977
2	4	.	7⅓	.	2⅓	1	.	4⅔	....	.	.....	....	.	988
2	5	.	9⅓	.	5	.	3⅔	.	....	.	.....	....	.	970
28	7	⅓	4	.	5⅓	1⅓	.	.	26.40	4	.....	....	.	1045
29	6	.	1⅓	.	9	2⅔	⅓	.	....	.	.....	....	.	1056
28	6⅔	.	1	⅔	4⅓	1	1⅔	3	35.17	5	.....	...	.	989
28	3⅔	⅓	1⅓	1	3⅔	3	.	⅓	36.49	2	.....	41.85	2	974
28	⅓	.	4⅓	⅓	4	.	4	.	....	.	.....	45.00	.	960
28	1⅔	.	1	.	7	.	13⅔	1⅔	....	.	.....	....	.	965
28	3⅔	.	3⅔	.	3⅓	⅓	13	⅓	....	.	.....	....	.	961
28	2⅔	.	1⅔	1	2⅓	⅔	5⅔	.	....	.	.....	....	.	1013
28	.	.	16⅓	.	6⅓	.	.	⅓	....	.	.....	....	.	995
28	5⅓	⅓	1⅔	⅓	12⅓	.	⅓	1⅓	....	.	.....	....	.	967
27	6⅔	.	3⅓	.	8⅔	.	⅓	2	....	.	.....	40.54	3	1007
27	7⅓	.	9⅓	1	1⅔	.	4	⅔	....	.	.....	...	.	962
28	1	10⅔	2	4	.	2⅔	.	5	....	.	.....	....	.	964
27	6	4⅓	4	2	1⅓	.	5⅔	⅓	....	.	.....	....	.	1043
28	⅔	.	5⅓	.	3⅔	.	14⅔	.	....	.	...	....	.	992
28	4	⅔	3⅔	⅓	1	.	15⅔	3	....	.	....	....	.	979
28.	1⅓	.	5⅔	.	1⅔	.	10⅓	⅔	....	.	.....	....	.	976
28.	3⅔	.	.	.	3⅔	.	.	19⅓	....	.	.....	....	.	968
..	12	.	7⅔	.	⅔	.	.	.	....	.	.....	....	.	963
8.	.	.	.	.	.	.	.	3	....	.	.....	....	.	1046
8.	3	.	1⅓	⅔	4⅔	⅓	⅓	6⅓	....	.	.....	....	.	975
8.	2	1	4	⅓	3⅔	⅔	5⅓	.	....	.	.....	....	.	980

METEOROLOGICAL REPORT
FOR THE STATE OF PENNSYLVANIA,
Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

FEBRUARY, 1840.

Thermometer.

County.	Town.	Observer.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.
1 Philadelphia.												
2 Montgomery.												
3 Bucks.	Newtown,	L. H. Parsons,	32.72	44.55	36.60	68.00	— 1.00	37.96	⅓	— 6.00	28.00	.
4 Lehigh.												
5 Northampton.	Easton.	Lafayette College,	30.07	39.48	34.83	64.00	— 2.00	34.79	.	....	....	.
6 Monroe.	Stroudsburg,	A. M. Stokes,	28.28	38.79	33.20	65.00	0.00	33.42	5	....	....	.
7 Pike,												
8 Wayne,												
9 Susquehanna.	Silver Lake,	E. W. Rose,	25.69	35.38	30.28	55.00	— 4.00	30.45	.	—10.00	23.10	.
10 Luzerne,	Wilkesbarre,	W. F. Dennis,	28.41	42.61	34.17	70.00	— 3.00	35.06	⅓	— 2.00	26.10	.
11 Schuylkill,												
12 Berks.	Reading,	C. F. Egelmann,	32.76	39.34	36.10	62.00	2.00	36.07	.	....	....	.
13 Chester,												
14 Delaware.	Haverford,	Haverford School.	33.67	44.81	39.22	68.00	4.00	39.23	3⅓	4.00	31.57	1
15 Lancaster.	Lancaster,	Conservatory of Arts.	34.60	46.57	37.80	69.50	2.00	39.66	⅓	2.00	30.86	
16 York,												
17 Lebanon.												
18 Dauphin.												
19 Northumberland.	Northumberland.	Andrew C. Huston,	30.33	42.16	35.31	64.00	4.00	35.93	.	— 1.00	26.48	.
20 Columbia.												
21 Bradford,												
22 Tioga.												
23 Lycoming,												
24 Union.												
25 Mifflin,												
26 Juniata,	Mifflintown,	J. A. Rinkead,	28.17	44.27	34.89	63.00	— 2.00	35.78	1⅓	....	....	.
27 Perry.												
28 Cumberland.	Carlisle,	Prof. W. H. Allen,	29.24	41.07	34.90	65.00	— 5.00	35.07	⅓	— 5.00	27.31	.
29 Adams.	Gettysburg,	Prof. M. Jacobs,	30.69	44.72	37.35	65.00	— 3.00	37.56	.	— 3.00	28.25	.
30 Franklin.												
31 Huntingdon,	Huntingdon,	Jacob Miller,	30.83	43.48	34.68	66.00	2.00	36.33	1	1.00	26.00	.
32 Centre,	Bellefonte,	John Harris,	27.28	40.03	31.96	62.00	—10.00	33.09	⅓	—13.00	21.74	2
33 Potter.												
34 M'Kean.	Smithport,	Richard Chadwick,	25.48	40.14	28.30	62.00	—12.00	31.31	⅓	—12.00	21.14	1
35 Clearfield.												
36 Cambria,	Ebensburgh,	Richard Lewis,	29.03	41.63	33.90	62.00	0.00	34.85	⅔	....	....	.
37 Bedford.	Bedford,	Samuel Brown,	35.04	49.39	43.19	69.40	18.00	42.54	5⅔	....	....	.
38 Somerset,	Somerset,	George Mowry,	30.79	44.29	36.40	61.00	—10.00	37.16	⅓	....	....	.
39 Indiana.	Indiana,	Richard White,	34.70	46.10	36.14	71.00	1.00	38.98	.	....	....	.
40 Jefferson,	Rose Cottage,	C. C. Gaskell,	25.96	37.42	29.25	50.00	—12.00	30.88	3	....	....	.
41 Warren,	Warren,	R. Brown,	29.76	44.53	30.96	67.00	— 3.00	35.08	⅔	....	....	.
42 Venango,	Franklin,	Wm. Connelly,	29.10	44.00	36.79	72.00	0.00	36.63	.	....	....	.
43 Armstrong,												
44 Westmoreland,												
45 Fayette,												
46 Green.												
47 Washington,												
48 Allegheny,												
49 Beaver,												
50 Butler,	Butler,	Jacob Mechling,	29.02	45.34	35.67	70.00	— 6.00	36.68	.	....	....	.
51 Mercer,	West Greenville,	John Keck,	35.18	42.80	40.35	63.00	6.00	39.44	2⅔	...	....	.
52 Crawford,	Meadville,	J. Limber,	33.52	47.84	39.36	65.00	10.00	40.24	4	10.00	29.78	6
53 Erie,	Erie,	Park & Reid,	31.69	39.89	26.10	66.00	8.00	32.56	.	5.00	23.00	.

Barometer. / Weather.

County.	Bar. 7, A. M.	Bar. 2, P. M.	Bar. 9, P. M.	Bar. Maximum.	Bar. Minimum.	Bar. Mean.	Bar. Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.
3 Bucks.	30.15	30.11	30.12	30.54	29.58	30.13	⅓	9⅔	18⅓	1	....	....	....	....	3.385
5 Northampton.	....	....	....	....	....	....		.	.	.	....	....	....	....	.....
6 Monroe.	29.63	29.62	29.40	30.05	29.00	29.55	3⅔	6	20	3	....	....	....	....	.....
9 Susquehanna.	28.07	28.06	28.08	28.30	27.50	28.07	.	10⅔	18⅓	.	6	1	...	..	1.990
10 Luzerne,	29.45	29.42	29.43	29.73	28.69	29.43	⅓	10⅓	18⅓	⅓	....	....	....	..	2.191
12 Berks.	29.91	29.94	29.91	30.25	29.22	29.93	.	9⅔	19⅓	.	8	1	1	..	.....
14 Delaware.	29.59	29.63	29.62	30.02	28.92	29.61	⅓	6	22⅔	⅓	....	....	....	..	3.108
15 Lancaster.	29.62	29.58	29.59	29.96	28.87	29.60	⅓	11⅔	17	⅓	10	2	....	..	2.151
19 Northumberland.	29.56	29.50	29.53	29.89	28.84	29.53	.	5⅓	23	⅔	5	3	1	..	2.645
26 Juniata,	29.52	29.54	29.54	29.90	28.80	29.53	1⅔	11⅓	15⅔	2	....	...	...	..	.....
28 Cumberland.	29.50	29.47	29.46	29.76	28.83	29.48	⅓	7⅔	21	⅓	6	1	....	1	1.7[illegible]7
29 Adams.	29.50	29.46	29.48	29.75	28.84	29.48	.	11⅓	17⅓	⅓	....	....	....	..	1.977
31 Huntingdon,	29.45	29.36	29.41	29.76	28.78	29.41	1	17	12	.	1	1	....	1	.....
32 Centre,	29.32	29.31	29.37	29.66	28.64	29.33	1	8	20	1	....	....	....	..	2.050
34 M'Kean.	28.16	28.17	28.15	28.45	27.60	28.16	⅔	5⅓	23	⅔	....	....	....	..	2.175
36 Cambria,	27.81	27.81	27.82	28.10	27.20	27.81	⅔	10	17⅔	1⅓	....	....	....	..	1.209
37 Bedford.	29.26	29.20	29.23	29.53	28.61	29.23	5⅔	8	15⅓	5⅔	....	....	....	..	.....
38 Somerset,	28.04	28.02	28.01	28.26	27.57	28.02	⅓	9	19⅔	⅓	....	....	....	..	1.712
39 Indiana.	28.65	28.59	28.62	28.90	28.00	28.62	.	1[illegible]⅓	18⅔	.	10	3	....	..	3.051
40 Jefferson,	28.94	28.90	28.91	29.20	28.40	28.92	2⅔	6⅓	20	2⅔	....	....	....	..	2.920
41 Warren,	28.82	28.83	28.84	29.50	28.20	28.83	⅔	6⅔	21⅔	⅔	....	....	...	..	.....
42 Venango,	29.15	29.03	....	29.50	28.50	29.09	17⅔	.	.	.	....	....	....	..	2.430
50 Butler,	....	....	....	....	....	....	.	.	.	.	....	....	....	..	2.312
51 Mercer,	28.84	28.78	28.76	29.44	28.22	28.79	2⅔	3⅔	10⅓	15	....	....	....	..	.....
52 Crawford,	28.76	28.72	28.73	29.09	28.10	28.74	4	6⅔	18⅓	4	....	....	....	..	.....
53 Erie,	29.48	29.46	29.45	29.85	28.69	29.46	.	6⅓	22⅔	.	5	2	....	..	2.010

Winds. / Hygrometer.

County.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
3 Bucks.	.	.	4⅓	⅓	.	.	3⅓	.	½	.	7⅔	.	⅔	.	12	.	.	⅓	....		.....	....	.	992
5 Northampton.	10⅓	⅔	5	.	3	.	3	.	3	.	3	.	.	.	1	.	.	.	....		.....	....	.	977
6 Monroe.	2⅓	⅔	1⅔	.	2⅔	.	⅓	.	1⅔	⅓	4	.	7⅓	.	2½	1	.	4⅔	....		.....	....	.	995
9 Susquehanna.	1⅓	.	.	.	.	.	1⅓	.	3⅓	.	5	.	9⅓	.	5	.	3⅔	.	....		.....	....	.	97[illegible]
10 Luzerne,	3	.	2⅓	.	.	⅓	.	.	4⅓	⅔	7	⅓	4	.	5½	1⅓	.	.	25.40	4	.....	....	.	1045
12 Berks.	.	.	.	.	1⅔	.	6⅓	.	⅔	⅓	6	.	1⅓	.	9	2⅔	⅓	.	....		.....	....	.	1055
14 Delaware.	2	⅓	2	.	1⅓	.	⅓	.	3⅓	1⅓	6⅔	.	1	⅔	4⅓	1	1⅔	3	33.17	5	.....	...	.	986
15 Lancaster.	1⅓	⅓	1⅔	2	2½	1⅓	1	1⅓	3	1⅓	3⅔	⅓	1⅓	1	3⅔	3	.	⅓	36.49	2	.....	41.35	2	974
19 Northumberland.	6	.	⅔	.	1⅓	.	3⅓	⅓	4⅓	.	⅓	.	4⅓	⅓	4	.	4	.	....		.....	45.70	.	95[illegible]
26 Juniata,	.	.	2	.	⅓	.	1⅔	.	.	.	1⅔	.	1	.	7	.	15⅔	1⅔	....	.	.....	....	.	96[illegible]
28 Cumberland.	⅓	.	⅔	.	1⅔	.	1⅔	⅓	.	.	3⅔	.	3⅔	.	3⅓	⅓	15	⅓	....	.	.....	....	.	961
29 Adams.	6	⅓	⅓	.	⅓	.	.	⅓	4⅓	3½	2⅔	.	1⅔	1	2½	⅔	5⅔	.	....	.	.....	....	.	[illegible]
31 Huntingdon,	⅓	.	.	.	5	.	.	.	⅔	.	.	.	16⅔	.	6⅓	.	.	⅓	....	.	.....	....	.	993
32 Centre,	1	⅓	4	.	1⅓	.	⅔	.	.	.	5⅓	⅓	1⅔	⅓	12⅓	.	½	1½	....	.	.....	....	.	967
34 M'Kean.	.	.	.	.	4⅓	.	3⅔	.	.	.	6⅔	.	3⅓	.	8⅔	.	½	2	....	.	.....	40.54	3	[illegible]
36 Cambria,	.	.	.	.	⅔	.	2	.	2⅓	.	7⅓	.	9⅓	1	1⅔	.	4	⅔	....	.	.....	..	.	[illegible]
37 Bedford.	.	.	.	.	.	1⅔	.	⅔	.	1⅔	1	10⅔	2	4	.	2⅔	.	5	....	.	.....	....	.	[illegible]
38 Somerset,	.	.	.	.	.	⅓	.	.	5	.	6	4⅓	4	2	1½	.	5⅔	⅓	....	.	.....	....	.	[illegible]
39 Indiana.	.	.	.	.	⅓	.	⅔	.	3⅔	.	⅔	.	5⅓	.	3⅔	.	14⅔	.	....	.	.....	....	.	[illegible]
40 Jefferson,	.	.	.	.	.	.	⅔	.	.	.	4	⅔	3⅔	⅓	1	.	15⅔	3	....	.	.....	....	.	[illegible]
41 Warren,	2⅔	.	⅓	.	.	.	⅓	.	6	.	1⅓	.	5⅔	.	1⅔	.	10⅓	⅔	....	.	.....	....	.	[illegible]
42 Venango,	.	.	.	.	.	.	2⅓	.	.	.	3⅔	.	.	.	3⅔	.	.	19⅓	....	.	.....	....	.	[illegible]
50 Butler,	.	.	.	.	5	.	1⅓	.	2⅓	.	12	.	7⅔	.	⅔	.	.	.	....	.	.....	....	.	[illegible]
51 Mercer,	4	.	.	.	.	.	.	.	22	.	.	.	.	.	.	.	.	3	....	.	.....	....	.	[illegible]
52 Crawford,	⅔	.	⅔	.	.	1	6⅔	1	2⅓	.	3	.	1⅓	⅓	4⅔	⅓	⅓	6⅓	....	.	.....	...	.	[illegible]
53 Erie,	⅔	1	⅓	.	⅓	.	1⅔	1⅔	5⅔	⅔	2	1	4	⅓	3⅔	⅔	5⅓	.	....	.	.....	....	.	[illegible]

JOURNAL

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AND

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OCTOBER, 1840.

Civil Engineering.

Letters from the United States of North America on Internal Improvements, Steam Navigation, Banking, &c., written by Francis Anthony Chevalier de Gerstner, *during his sojourn in the United States, in* 1839.

(Translated from the German, by L. Klein, Civil Engineer.)

The late Chevalier de Gerstner, so well known to the public by the construction of the first railroads in Austria and Russia, and as the author of several important works, came to the United States in the autumn of 1838, intending to make himself acquainted with the public works, and principally the railroads in this country, and to publish, on his return to Europe, a large work on these interesting subjects. Desiring to communicate to the European public some of his observations, even during his journey, he wrote a series of letters, which were inserted in all the principal papers in Germany. One of these letters, containing a comparison of the railroads in Belgium* with those in the United States, has already been laid before the public in America, and from the general interest with which it was received, and its republication in so many periodicals, we may infer, that a translation of the other nine letters will be acceptable to the readers of the Journal.

Letter I.

Boston, January 15, 1839.

The rapid growth of the prosperity of the United States of North America, has excited, since many years, public attention in Europe, and I have

* See Journal Franklin Institute, vol. xxiv., p. 145.

been long desirous to visit that remarkable country. The long passage of sailing packets, however, has deterred me like many others; but what until lately was thought impossible—the steam navigation across the Atlantic—has been proved practicable in 1838, by the frequent, safe, and swift passages of the four English steamships. I left the Old World from Bristol, on the 27th of October, 1838, in the steamer Great Western, and arrived in New York on the 15th November, 1838. After a stay of one week in that city, I took a steamboat to Albany, on the Hudson river, from whence I proceeded to Buffalo, on Lake Erie, in order to inspect the canal between the two cities, as well as the several railroads in its vicinity. I then went to the Eastern States, and visited from Boston the different railroads and other improvements of this interesting country. My object was much forwarded by the kind reception I every where met with; but even without letters of introduction, every body, by the publicity which is so general here, may find much instruction and information, which he seeks in Europe in vain. On all public works a statement is annually made to the individuals concerned, and generally published and distributed in many copies. Railroad companies have to make annual reports to the legislatures from which they obtained their charters, and these reports are printed in Massachusetts, Virginia, and other states, for the instruction of the public, and a great many copies distributed. There can exist no doubt as to the accuracy of these reports, as they are certified by oath by the directors, when made to the state; but besides, there seldom exists any objection on the part of the managers, to open for inspection the books of public institutions.

There are three causes principally to which the United States owe their prosperity. The schools, which diffuse general knowledge, and enable every man correctly to judge of his enterprise, and to calculate the results; the banks, eight hundred in number, which procure every body the facility to raise funds proportionate to his ability, and enable him to enter into every speculation; finally railroads, canals, and steam navigation, which facilitate intercourse, in this immense country, in a manner, of which one can form only a very imperfect idea without having witnessed it. I commence my reports in an inverse order, speaking first of railroads and canals, in the following letters I will also treat of schools and banks.

Erie Canal, in the State of New York.

With the exception of only a few canals and railroads, all improvements of this kind originated within the last twenty years. The principal impulse to internal improvements was given by the results of the Erie Canal, the object of which, independently of the great local advantages, was to connect the fertile Western States of Michigan, Illinois, Ohio, and Indiana, and the western part of the state of New York, with the river Hudson, and thereby with the city of New York, the great commercial emporium of the United States. This canal extends from Albany, on the Hudson, to Buffalo, on Lake Erie, and is 363 miles in length; with its branches, 640 miles. On its length there are 394 locks, 72 aqueducts, and 1065 bridges: the main canal is 40 feet wide, 4 feet deep, and has single locks. The lateral canals are generally of the same dimensions. The construction of the canal was commenced on the 4th of July, 1817, and in October, 1825, the main line of 363 miles was opened. The expenses of construction of the main canal, and of the lateral canals, partly constructed afterwards, amounted to 12,000,000 dollars, and the greatest part of the capital was procured by

loans made by the state; but as it was feared, at first, that the tolls on the canal would not suffice to cover the interest on the loans, a tax was levied by the state from auctions, salt, and steamboats, and the proceeds thereof applied to the canal fund. From the period the canal has been partly put in operation, the annual receipts in tolls have been as follows, viz.

		On the Erie Canal alone.	On all the State canals.
In the year	1820	5,437	5,437
"	1821	14,388	14,388
"	1822	64,072	64,072
"	1823	152,958	152,958
"	1824	340,761	340,761
"	1825	566,113	566,113
"	1826	762,004	762,004
"	1827	859,058	859,058
"	1828	835,407	838,445
"	1829	795,054	813,137
"	1830	1,032,599	1,056,922
9 months ending Sept.	1831	833,349	854,288
Year ending Sept.	1832	1,060,221	1,086,434
"	1833	1,288,093	1,461,574
"	1834	1,178,298	1,338,393
"	1835	1,367,748	1,539,598
"	1836	1,434,030	1,607,295
"	1837	1,137,825	1,285,911
"	1838	1,405,182	1,581,386
		15,132,597	16,228,174

The annual expenses for collection and repairs amounted to about one-third of the revenue.

These numbers show, that the net profit of the canal has paid back, within a few years, the whole capital of construction, and that the state, therefore, by lending its credit for the completion of this large work, has not only increased the welfare and resources of the country, but created, besides, a source of considerable annual revenue.

The canal is at present navigated by 2500 boats, upon which 12,000 persons are engaged. But the rapid development of the Western States has so much increased the traffic upon the same, that an enlargement of the main canal, from 40 to 70 feet in width, and from 4 to 7 feet in depth, was thought necessary; as at the same time the locks, aqueducts, and bridges have to be reconstructed, the cost of the enlargement will exceed 20,000,000 dollars, and 5 or 6 years will be required for its completion.

Besides the enlargement of the main canal, two lateral canals are now in progress of construction, at the expense of the state. Their length is 167 miles, and their cost is estimated at 6,200,000 dollars; in a few years, therefore, the total length of the main canal and its lateral branches will be 807 miles.

Certainly, no other country in the world can boast of a canal of such length, which, completed in a few years, has given such immense results.

Railroads along the Erie Canal.

Besides produce and merchandize, passengers are also transported upon

the Erie Canal; but the latter accommodation having been found inadequate from the constantly increasing intercourse, chartered companies were formed within the last few years for the construction of a railroad in the valley of the canal. This railroad consists of the following seven sections, connected with each other, but each of them belonging to a separate company:

1. From Albany to Schenectady, already 6 years in operation, ...	$16\frac{1}{3}$	miles.
2. From Schenectady to Utica, since 2 years in operation,	$77\frac{1}{3}$	do.
3. From Utica to Syracuse, the grading finished, and only the iron bars wanting, ...	$52\frac{3}{4}$	do.
4. From Syracuse to Auburn, 1 year in operation, .	$25\frac{3}{4}$	do.
5. From Auburn to Rochester, in progress of construction,	78	do.
6. From Rochester to Batavia, one year in operation,	32	do.
7. From Batavia to Buffalo, the construction to commence early in 1839, ...	36	do.
Total length, ...	318	miles.

The stockholders of these railroads are, for the greatest part, the farmers and mechanics of the respective counties, or the merchants trading in that vicinity. The profit arising to these classes by the construction of the roads is greater than the interest on their investments. For this reason the shares of two companies only are offered in the market, while the others are kept by the original subscribers.

It is an important feature of this and almost all other railroads in the United States, that they traverse the cities and villages situated on the lines, and lateral branches often lead through much frequented and populous streets; in the more densely peopled part of large cities, however, the use of horse power only is admitted. As in winter the snow often covers the whole country and the railroads frequently go through deep excavations, a suitable apparatus has been invented for clearing off the snow, and there is little difficulty in using the roads at all seasons. The railroads are travelled over day and night; in the latter, principally for the purpose of forwarding the mail without detention. A particular car (mail car) is employed in such cases, and forms the *travelling post office;* it consists of a heated room, occupied by a clerk of the Post Office Department, who, during the journey, distributes the letters obtained along the road in twenty or more boxes, from which they are taken and put in bags on approaching the respective places; the letter bag is then delivered and another received in exchange, for which operation never more than two minutes are allowed.

The cost of the several railroads differs much, according to the obstacles encountered in their location. But besides this, most of the companies, and principally such as are composed of the landholders on the line, have, as it were, appropriated a certain sum for the construction of the road, proportioned to the expected traffic upon the same, and it then became the affair of the engineer to make his plans accordingly.

The Americans prefer an inferior railroad, upon which they can travel with a speed of from 8 to 12 miles, to a common road, upon which they move with only half that speed; in America all such works are made in conformity with the local wants and circumstances, and never, as in the old world, planned after a universal model. Every railroad here shows, therefore, some peculiarities, and a judge of their true merits, can, in my opinion, learn more here in regard to internal improvements than in any

other country in the world. It will now be understood why, of the above seven railroads, the average cost per mile varies from 5,000 to 72,000 dollars, while the iron rails or bars are nearly on all of the same strength, in order that locomotive engines may be used upon them.

Other Railroads in the State of New York.

Besides the railroads above enumerated, the following are in operation in that state:—

From Schenectady to Saratoga,	$21\frac{1}{2}$	miles.
From Troy to Ballston,	25	do.
From Buffalo to Niagara Falls,	$22\frac{1}{4}$	do.
From Niagara Falls to Lockport,	24	do.
From Ithaca to Owego,	$28\frac{3}{4}$	do.
From Hudson to West Stockbridge,	$34\frac{3}{4}$	do.
From Brooklyn to Hicksville,	$26\frac{1}{4}$	do.
Some other short roads,	50	do.
Total length,	$232\frac{1}{2}$	miles.

The following are in progress of construction:

A railroad from the Hudson, near New York, direct to Lake Erie,	454	miles.
From New York, nearly parallel to the Hudson river, to Albany, to be used principally during the winter, when the river navigation is stopped,	$147\frac{1}{2}$	do.
From Catskill to Canajoharie,	72	do.
From Corning to the state line of Pennsylvania,	$14\frac{1}{2}$	do.
From Saratoga to Whitehall,	40	do.
Total,	728	miles.

With the above mentioned lines along the Erie Canal, there are, therefore, in total:—

Railroads completed,	384	miles.
Railroads in progress,	$894\frac{3}{4}$	do.
	$1278\frac{3}{4}$	miles.

To aid in the construction of these railroads, the State of New York has guaranteed the following loans:

1. To the New York and Erie Railroad Company, the State has promised already in the charter,	$3,000,000
2. To the Ithaca and Owego Railroad Company,	300,000
3. To the Auburn and Syracuse Railroad Company,	200,000
4. To the Catskill and Canajoharie do.	300,000
5. Besides to the Delaware and Hudson Canal Company,	800,000
Total,	$4,600,000

A part of these loans has been already realized, and the remainder is obtained as the works advance.

The total cost of all the railroads and canals, completed and in progress, in the State of New York, will amount to about 70,000,000 dollars, while the population of the State at the last census, in 1830, was only 1,918,608, and may now amount to 2,500,000. This gives, per head, an expense of 23 dollars for internal improvements.

Railroads in the State of Massachusetts.

The most solid railroads, and which compare best with the European structures, are those constructed in the State of Massachusetts. They are:

From Boston to Worcester,	44	miles.
From Boston to Providence,	41	do.
From Boston to Lowell,	26	do.
From Lowell to Nashua,	14	do.
From Lowell Railroad to Haverhill,	17	do.
From Boston to Salem,	13	do
From the Boston and Providence Railroad to Taunton,	11	do.
The following railroads are in progress of construction:—		
From Salem to Newburyport,	21	do.
From Worcester to Norwich,	60	do.
From Worcester to West Stockbridge,	117	do.
Total length of railroads in Massachusetts,	364	miles,

of which 166 miles are in operation.

The following loans have been granted by the State:

1. For the railroad from Worcester to West Stockbridge, the State subscribed one-third of the stock, and guaranteed a loan of	\$2,100,000
2. For the railroad from Worcester to Norwich,	400,000
3. For the railroad from Boston to Newburyport,	590,000
4. For the Andover and Haverhill Railroad,	50,000
Total,	\$3,140,000

The population of this State was, at the last census, (1830) only 610,408, and may now be about 700,000; if this number be compared with the amount of state loans, it shows that four dollars and a half per head were loaned for the construction of railroads. The loans of this State were negotiated in England; the last 5 per cent. loan brought a premium of 10 per cent.

The Railroad from Boston to Lake Erie, compared with that from St. Petersburg to Moscow to Colomna.

I cannot close this letter without making the following remarkable comparison. The railroad from Boston through Albany to Buffalo, on Lake Erie, will be completed within two or three years, and have a length of $519\frac{1}{2}$ miles, or 775 Russian wersts. Boston, Albany, and Buffalo are situated in nearly a direct line, like St. Petersburg, Moscow, and Colomna. A railroad connecting the latter three cities, and extending to the river Oka, would also measure $774\frac{1}{2}$ wersts, if its length is equal to that of the present

turnpike road. The object of the American railroad is the connexion of the fertile Western States with the harbour of Boston; that of the Russian, to connect the not less fertile country on the river Wolga, and the centre of the large empire, with the capital and harbour of St. Petersburg. In America, this long railroad was commenced in 1832, with the section from Albany to Schenectady, of 16 miles in length; in Russia, the great work was begun in 1836, with a railroad of equal length between St. Petersburg and Zarskoe-Selo. The American railroad was undertaken by private individuals, with the assistance of the States; what should prevent the accomplishment of a similar project in Russia, where the greatest monuments of the age have already been erected by Peter the Great and his successors?

Letter II.

Finances of the State of New York.

Philadelphia, February 22, 1839.

The State of New York is the most prosperous and populous amongst the 26 States at present forming the Union, although in the extent of the surface it is exceeded by eight other States.

The area of New York is 46,200 square miles: its population was in the year

1790,	340,120,	and the whole population of the	U.	States,	3,929,827
1800,	586,756,	do.	do.	do.	5,305,925
1810,	959,949,	do.	do.	do.	7,239,814
1820,	1,372,812,	do.	do.	do.	9,638,131
1830,	1,918,608,	do.	do.	do.	12,866,920

I have stated in my first letter, that the State of New York gave the principal impulse to the construction of canals and railroads in the United States, by the completion of the grand Erie Canal. Upon this canal there are now annually transported produce and merchandize of twenty-two millions in value, and 700,000 tons in weight; the tolls have paid back the capital invested in its construction, and yield at present a surplus for the State treasury. The property in the vicinity of the canal rose to at least five times its former value, and village after village originated on its borders, like the city of Rochester for instance, which now contains 20,000 prosperous inhabitants, while in 1812, only a few log huts were visible amidst the woods. Nothing but such an example was required to give rise to numerous projects for canals and railroads all over the Union, of whose magnitude and consequence for the prosperity of the country, no correct idea can be formed in Europe.

In the year 1838, the Legislature of the State of New York appointed a committee to inquire into the finances and the prosperity of the State, and to report whether the Legislature ought to appropriate further sums for internal improvements. The report of this committee, as also the annual report of the Comptroller of the State, have lately been published, and contain the following interesting data:

The annual expenses of the State Government amount to 400,000 dollars.

They comprise the salary of the Governor, 4000 dollars, of the Auditor, 2500 dollars, of the Secretary of State, 2500 dollars, and of the Comptroller, 2500 dollars: the other State officers receive smaller salaries; most of the other expenses are incurred by the Legislative Assembly and the Courts. Until 1826, a tax had been levied from all real and personal property, to defray the expenses of the State Government; since that time, or since thirteen years, this tax was discontinued, and the expenses of the State Government are defrayed only from a tax imposed on public auctions, and the duty on salt.

The State of New York had, on the 1st of January, 1837, 977,532 dollars of old debts, and 3,555,224 dollars debts for new canals, amounting together to 4,532,756 dollars, while the surplus revenue from canal tolls, after deducting the expenses for collection and repairs, amounted in one year, to 1,107,871 dollars. This surplus revenue is equal to the interest, at 5 per cent., on a capital of 22,157,420 dollars; and after deducting the above debt of 4,532,756 dollars, there still remain 17,624,664 dollars as the productive funds of the State. It had besides, on the 30th September, 1838, a fund of 1,929,707 dollars for common schools, and one of 268,093 dollars for the maintenance of schools for the higher branches of education; finally, in 1837, the State received from the General Government its share out of the surplus revenue of 42 millions, to the amount of 4,014,520 dollars, which sum has meanwhile laid on interest.

For the maintenance of roads, charitable institutions, schools, &c. in the towns and districts, a tax is levied, through the whole State, from all real and personal property; and the latter, therefore, assessed annually by a committee appointed for that purpose. This real and personal property amounted,

In 1820, to - -	255,552,365	dollars.
1830, to - -	319,118,296	do.
1838, to - -	627,544,784	do.

and the whole tax thereon was, in 1838, 2,860,476 dollars.

Supposing the population of New York in 1838, at 2,500,000, the property per head amounted to 251 dollars, which is rather below the actual amount, as in all such cases, when done for the purpose of taxation, the property is assessed below its value. Of this considerable property, the taxes in 1838, were only \$1 14 per head.

Under these favourable circumstances, the committee appointed by the Legislature proposed an annual appropriation of four millions of dollars, during the succeeding ten years, or in the whole, of forty millions of dollars for the construction of railroads and canals.

The most Expensive Railroad in the United States.

In Europe the opinion prevails, that the American railroads are all of an inferior construction, with weak iron bars, short curves, and steep grades; that in constructing them only cheapness and economy were kept in view, and therefore they cannot be regarded as examples for imitation in Europe. I have already, in a former letter, explained my views on the American railroads, and after having, within the last three months, travelled over 24 railroads, of an aggregate length of 750 miles, inspected their construction, and made extracts of the accounts of their operations, I do not hesitate to repeat, that the system of the American railroads, constructed as they are, in a climate similar to that in Germany, and used in winter as

well as in summer, appears to me more worthy of imitation in Germany and in Russia, than the English railroads, and that an engineer can undoubtedly acquire more experience here, than any where else, provided he is able to find out, amongst the numerous experiments made here on every branch of construction, what is good and approved.

Wherever it was not necessary, the Americans have not economised in the construction of their railroads; this has been proved principally in the establishment of a railroad within the city of New York. This city is located upon an island, extends about eight miles to the Harlaem river, and has an average width of two miles only. The lower, or southern, part of the city contains now a population of 300,000, and as the annual increase in the number of inhabitants is nearly 15,000, requiring from 800 to 1,000 new houses, the northern parts of the city must constantly become more and more built up, and inhabited. The property owners in these parts of the city, united, therefore, eight years ago, and subscribed the capital for a railroad, commencing in the most populous part of the city, (near the City Hall) and extending through several streets, and the still unimproved grounds, to the last buildings on the Harlaem river, or to 133d street. The railroad has a double track, and is built five miles in a straight line, with very easy grades, to attain which, a tunnel had to be excavated through a very hard rock; and amongst other bridges, one with four spans, (the largest of 175 feet) the piers and abutments of stone, to be constructed. The iron bars weigh only 15 lbs. to the yard, notwithstanding which, the expenses of construction amounted, at the close of 1838, to 1,060,000 dollars, and will, after the entire completion, probably not fall short of 1,200,000 dollars. The cost of this road per mile, will therefore be 150,000 dollars; to which must be added the cost of exchanging the flat bars for heavy iron rails, weighing probably 58 lbs. per yard, like those on several railroads in Massachusetts. This important railroad, called the New York and Harlaem Railroad, has been traveled over last year by 800,000 persons, and serves, at it were, as an omnibus within the limits of the city of New York; upon one-third of its length, horse power is used; and upon the remainder two-thirds, locomotive engines are employed. The construction of such a railroad certainly shows that the Americans expend large sums where it is necessary; but how much the introduction of railroads has been facilitated in this country, the number of locomotives manufactured here within the last few years will show.

Steamboats, Locomotive Engines, and Stationary Steam Engines, in the United States.

The Secretary of the Treasury has lately made to Congress a very interesting report on these subjects. This report, which contains 472 pages, is founded upon official information up to the summer of 1838; according to the same, there were in the United States,

Steamboats built since 1807, - -	1300,	
Of which have been worn out, - -		240
Lost by accidents, - - - -		260
And are still in use, - - - - -		800
Tonnage of all steamboats, -	155,473	
Horse power of the engines of the same,	75,019	

The largest steamboat is the Natchez, of 860 tons, and 300 horse power. As fuel, wood is principally used.

Although many steamboats are propelled by two engines, each boat appears in the list with only one machine; therefore all

800 steamboats with - - -	800	steam engines;
To which the number of locomotives, -	350	do.
And in factories, &c., - - -	1860	do.
Total number, - -	3010	steam engines.

According to a report published in 1836, there were at that time in England only 600 steamboats, with a tonnage of 67,969. In France, the number of steamboats is much less.

The above mentioned 350 locomotives are used upon 54 railroads; the greatest number of locomotives is upon the Philadelphia and Columbia Railroad, of 82 miles in length, viz. 34.

The following statement is extracted from the Report of the Secretary of the Treasury:

Year.	Number of Locomotive Engines.		Total.
	Imported from England.	Manufactured in America.	
1831	1	0	1
1832	8	3	11
1833	13	4	17
1834	11	22	33
1835	19	36	55
1836	12	81	93
1837	20	76	96
1838	0	44	44
Total,	84	266	350

This remarkable statement shows best how soon American ingenuity succeeds in supplying the wants of the country; in 1831 the first locomotive engine was imported from England, because they could not manufacture it in America; but seven years later the English were driven from the market, and locomotives are now constructing in twenty-one American manufactories. Two locomotives have been sent already from here to Austria, one to Brunswick, and the day before yesterday, the first American locomotive engine, from the manufactory of Mr. William Norris, in Philadelphia, was shipped for England, to which nine others are to follow. There could indeed be no greater triumph for American machinists, than this order from England for ten locomotives!

Mr. William Norris, in Philadelphia, has, up to the 20th of February, 1839, constructed 73 engines, and Mr. M. W. Baldwin, up to the same day, 120; each of these manufacturers employs in his shop 250 workmen, and is so established as to be able to deliver one engine every week. The price of a locomotive engine, with tender, in both manufactories, varies from 7000 to 8000 dollars, according to the dimensions.

In the above statement, Mr. Norris appears only with 36, and Mr. Bald-

win with 91 engines, as the data reached only to the middle of 1838; the former has since that constructed and put upon the railroads in America, 31, and the latter 27 engines; and as at the same time other manufactories have also delivered several new locomotives, it may be asserted, that there are at present upon the railroads in the United States, 425 locomotive engines, of which only 84 were imported from England, and the remainder constructed, all within the last seven years, in this country. We may, therefore, justly anticipate, that the Americans, by prosecuting the improvements already commenced, will attain, in the construction of locomotive engines, a high degree of perfection, and supply Europe with many and good machines.

TO BE CONTINUED.

Note.—The article on the Railroads of the United States, published in our last number, was credited to the Chevalier de Gerstner by mistake; the name of Mr. L. Klein should have appeared as the author.

Com. Pub.

Railroads in the United States. By L. Klein, *Civil Engineer.*

These articles will contain a list of all railroads constructed, or in progress of construction, in the United States, up to the end of the year 1839, their names and direction, their length, the number of miles in operation, and in progress, the description of iron used thereon, the motive power used, and the number of locomotives employed; the amount expended, and that required to complete them; and finally, their total cost of construction, and the average cost per mile of each road.

No. 1.

Railroads in the State of New York.

The railroads in the State of New York have all been undertaken by private companies, and the capital necessary for their construction was partly paid in shares by private individuals, (stockholders) and partly obtained by private loans, contracted by the companies, when the amount of capital paid in was found inadequate to complete the works. Loans have been granted by the State to a few railroad companies, or rather the State issued its bonds to a certain amount, which were given to, and then sold by, the respective companies. With the exception of the Mohawk and Hudson and the Harlaem Railroads, all those in the State of New York have but a single track. The superstructure is of wood, with a flat iron bar fastened upon longitudinal string pieces, except in the Long Island Railroad, where a heavy T rail is used. The motive power is steam, a few short lines excepted, where horses are employed; and upon some certain roads which are but little frequented, horses are used in winter, when the expense of running locomotive engines would exceed the receipts from the traffic. The railroads constructed along the line of the Erie Canal are not allowed to carry freight, except by paying to the State the same amount of toll as is charged upon the canal; all other railroads carry freight and passengers, but derive their profit almost exclusively from passengers, the quantity of freight transported being so small, that the expenses incident thereto do not fall much short of the gross receipts.

List of Railroads completed or in progress in the State of New York, at the close of 1839.

No.	Name of Railroad.	From and to where.	Opened. Year.	Opened. Miles.	No. miles. graded.	No. miles. Not yet graded.	Total length of road.	Dimensions or weight of iron bars or rails.	Motive power employed	Amount of capital expended.	Amount wanted for completion.	Total cost of railroad	Cost per mile.
							miles	inch.		Dollars.	Dollars.	Dollars.	Dollars
1	Mohawk and Hudson,	Albany to Schenectady	1832	$16\frac{1}{3}$			$16\frac{1}{3}$	flat bar $2\frac{1}{2}\times$9-16	1 locomt.	1.136.000		1.136.000	69.735
2	Utica and Schenectady,	Schenectady to Utica	1836	$77\frac{1}{3}$			$77\frac{1}{3}$	do. $2\frac{1}{2}\times\frac{3}{4}$	} 12 do.	1.850.000		1.850.000	23.922
3	Syracuse and Utica,	Utica to Syracuse	1839	$52\frac{3}{4}$			$52\frac{3}{4}$	do. $2\frac{1}{2}\times\frac{3}{4}$		912.000	50.000	962.000	18.237
4	Auburn and Syracuse,	Syracuse to Auburn	1837	$25\frac{3}{4}$			$25\frac{3}{4}$	do. $2\frac{1}{2}\times\frac{3}{4}$	3 locomt.	630.000		630.000	24.466
5	Auburn and Rochester,	Auburn to Rochester			25	53	78	rail 40lb intended		230.000	1.270.000	1.500.000	19.231
6	Tonawanda,	Rochester to Batavia	1837	32			32	flat bar $2\frac{1}{2}\times\frac{5}{8}$	3 locomt.	575.400		575.400	17.981
7	Buffalo and Niagara Falls,	Buffalo to Niagara Falls	1837	$22\frac{3}{16}$			$22\frac{3}{16}$	$2\frac{1}{2}\times\frac{1}{2}$	3 locomt.	165.000		165.000	7.437
8	Buffalo and Blackrock,	Buffalo to Blackrock	1834	$3\frac{1}{16}$			$3\frac{1}{16}$	$2\times\frac{1}{2}$	horses.	20.000		20.000	6.531
9	Lockport and Niagara Falls,	Lockport to Niagara Falls	1837	24			24	$2\frac{1}{4}\times\frac{5}{8}$	2 locomt.	195.000		195.000	8.125
10	Lewiston Branch,	Lewiston to Lockport and Niagara Falls Railroad	1837	$3\frac{1}{3}$			$3\frac{1}{3}$	$2\frac{1}{2}\times\frac{5}{8}$	horses.	27.000	3.000	30.000	9.000
11	Medina and Darien,	Medina to Pembroke	1836	20			20	0*	horses.	40.000		40.000	2.000
12	Rochester,	Rochester to Carthage	1833	3			3	$2\times\frac{1}{2}$	horses.	30.000		30.000	10.000
13	Scottsville and Caledonia,	Scottsville to Caledonia	1838	8			8	0	horses.	32.000		32.000	4.000
14	Skeneateles,	Skeneateles to Auburn & Syracuse Railroad			3	$2\frac{1}{4}$	$5\frac{1}{4}$	0	horses.	7.500	22.500	30.000	5.714
15	Syracuse and Onondaga,	Syracuse to Onondaga Quarries,	1837	$4\frac{1}{2}$			$4\frac{1}{2}$	$2\frac{1}{4}\times\frac{5}{8}$	horses.	49.250		49.250	10.944
16	Schenectady and Saratoga,	Schenectady to Saratoga Springs	1832	$21\frac{1}{2}$			$21\frac{1}{2}$	$2\frac{1}{2}\times$9-16	2 locomt.	302.500		302.500	14.070

* This railroad has no iron, and the cars run upon wooden ribbons; it is the same case with the Scottsville and Caledonia, and the Skeneateles railroads.

List of Railroads completed or in progress in the State of New York at the close of 1839.—*Concluded.*

No.	Name of Railroad.	From and to where.	Opened. Year.	Opened. Miles.	No. miles graded.	No. miles Not yet graded.	Total length of road.	Dimensions or weight of iron bars or rails.	Motive power employed	Amount of capital expended.	Amount wanted for completion	Total cost of railroad.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
17	Saratoga and Washington,	Saratoga to Whitehall			10	30	40			60.000	440.000	500.000	12.500
18	Rensselaer and Saratoga,	Troy to Ballston	1835	25			25	flat bar, $2\frac{1}{4} \times \frac{5}{8}$	2 locomt.	487.000		487.000	19.480
19	Hudson and Berkshire,	Hudson to West Stockbridge	1838	$34\frac{3}{4}$			$34\frac{3}{4}$	$2\frac{1}{2} \times \frac{5}{8}$	3 locomt.	500.000	40.000	540.000	12.662
20	Cattskill and Canajoharie,	Cattskill to Canajoharie	1838	15*	11*	46	72	$2\frac{1}{4} \times \frac{5}{8}$	1 locomt.	300.000	700.000	1.000.000	13.889
21	Ithaca and Owego,	Ithaca to Owego	1834	$23\frac{3}{4}$			$28\frac{3}{4}$	$2\frac{1}{4} \times \frac{5}{8}$	1 locomt. & horses.	575.400		575.400	20.000
22	Corning and Blossburg,	Corning to Pennsylvania State Line			$14\frac{1}{4}$†		$14\frac{1}{4}$	$2\frac{1}{4} \times \frac{3}{4}$	2 locomt.	150.000		150.000	10.526
23	New York and Erie,	Tappan to Dunkirk			103	351	454			700.000	4.300.000	5.000.000	11.013
24	New York and Albany,	New York to Albany			4	$143\frac{1}{2}$	$147\frac{1}{2}$			50.500	2.742.500	2.800.000	18.983
25	New York and Harlaem,	New York to Harlaem	1839	8			8	$2\frac{1}{4} \times \frac{5}{8}$	4 locomt.	1.150.000	20.000	1.170.000	146.250
26	Brooklyn and Jamaica,	Brooklyn to Jamaica	1836	11			11	rail, 38 lbs.	$\left.\begin{matrix}\\ \\ \end{matrix}\right\}$ 3 do.	404.400	15.000	419.000	38.127
27	Long Island,	Jamaica to Greenport	1837	$15\frac{1}{4}$		68	$83\frac{1}{4}$	58 lbs.		732.850	900.000	1.632.850	19.614
28	Hempstead Branch,	Long Island Railroad to Hempstead	1839	$2\frac{1}{4}$			$2\frac{1}{4}$	bar, $2\frac{1}{4} \times \frac{5}{8}$	horses.	13.000		13.000	5.778
28	Railroads.			$453\frac{3}{4}$	$170\frac{1}{4}$	$693\frac{3}{4}$	$1317\frac{3}{4}$		45 locom.	11.331.800	10.503.000	21.834.800	16.570

* Of the Cattskill and Canajoharie Railroad, 26 miles are now in operation.

† The Corning and Blossburg Railroad is now opened; other $25\frac{3}{4}$ miles of this road are in Pennsylvania.

From the preceding table, we draw the following conclusions:

1. The railroads in the State of New York have been constructed by twenty-eight different companies; the first five form a continuous line of two hundred and eighty-two miles, of which two hundred and four miles are now in operation; when the railroad from Batavia to Buffalo, for which a charter has been obtained, shall have been constructed, there will be an uninterrupted railroad from Albany to Niagara Falls, of three hundred and sixty-four miles, equal to the length of the Erie Canal.

2. The *longest* railroad in the State, *completed* by one company, is that from Utica to Schenectady, and the *oldest* the one from Albany to Schenectady; in the same year with the latter, (1832) the continuation to Saratoga Springs was also put in operation.

3. The number of miles of railroads opened at the end of 1839, were $453\frac{3}{4}$, the number of miles prepared for the superstructure were at the same time $170\frac{1}{4}$, leaving on all the lines undertaken, $693\frac{3}{4}$ miles yet to be constructed; the total length of all the twenty-eight railroads will then be $1317\frac{3}{4}$ miles.

4. The number of railroads upon which locomotive engines are used is sixteen, and their length $423\frac{3}{4}$ miles, including the Blossburg railroad; the number of locomotives employed is forty-five, being at the rate of *one locomotive engine for* $9\frac{4}{10}$ *miles of road.*

5. The total amount of capital expended for railroads, at the end of 1839, was 11,311,800 dollars; the amount yet to be expended, 10,502,500 dollars, which will make the total cost of the twenty-eight railroads, when completed, equal to 21,814,800 dollars, and the *average cost per mile*, 16,570 *dollars*. The amounts required for completion are taken from the latest estimates of the engineers, and may, in some cases, be exceeded. Of the twenty-eight railroads, however, twenty-one are entirely finished; their aggregate length is $438\frac{1}{2}$ miles, and their total cost, 8,231,950 dollars; this gives, at an average, 18,773 *dollars per mile* of road, with a single track, including buildings and outfit.

TO BE CONTINUED.

Bibliographical Notices.

A Description of the Canals and Railroads of the United States, comprehending Notices of all the works of Internal Improvement throughout the several States. By H. S. Tanner. New York: Tanner & Disturnell, 1840. 8vo. p.p. 272.

We deem this book to be one of no common value to every person, be his habits locomotive or stationary, who feels an interest in the vast improvements which have distinguished the last quarter of a century in these United States. Lives the man, possessed of an ordinary share of curiosity, who can be content to *hear tell* of the great Erie Canal, of the warfare in Congress about the Cumberland Road, or of the prospect of being able to travel from Bangor to Pensacola, or New Orleans, and thence to Detroit or the Wisconsin River, without the necessity of leaving his cushioned seat in a beautiful railroad car, except to take the needful refreshments,—and yet feel no desire to have the particulars of this mighty progress? What history or what facts can be more interesting than those which relate to the triumphs of genius and art over the most formidable obstacles which rise in

opposition to the free and universal intercourse of man with man? We were forcibly struck the other day with one historical fact in relation to traveling, which finely contrasts with our present capacities. When Guy Fawkes was caught at midnight in the cellar of the Parliament House, with his dark lanthorn and matches in readiness to fire the train, and with his cloak and boots on, ready to escape to associates in the country, the city of London was thrown into the utmost tumult, as the news of the gunpowder plot flew from street to street. Several days elapsed before he made a confession of the extent of his guilt, and the names of his companions. The conspirators, to the number of eight, met at a house in Staffordshire, just about one hundred miles from London, and such was the rate of traveling at that period, although a trumpeter was sent in haste with a warrant to the Sheriff of the county to arrest them, it was not till *three days after* that the Sheriff heard of the conspiracy and received his order. The roads, it is acknowledged, were bad, and "traveling by night at that time was never contemplated."*

Next to the pleasure of traveling at the rate of twenty miles an hour in a joltless vehicle, amidst magnificent scenery, is that of having a good guide book and map in hand, to inform one of the names of the towns, rivers and mountains which constitute the objects of the moving picture which is thus flying around us, and captivating and tantalizing our vision. To pass along with our eyes shut, regardless of the means by which we are thus transported, and of the immense labour, cost and ingenuity by which this astonishing time-saving and world-changing scene has been accomplished, is as stupid as traveling from Dan to Beersheba, and calling it all barren. Not the least of the enjoyment is the consciousness that the increased rapidity of our movements is not gained at the expense of the sweat and sinews of that noble animal, of whose lives and hardships all stage competition has hitherto been so regardless. But by what means is all this effected? What is a locomotive, or railroad steam engine? What is the *power* that thus carries us with the swiftness of the wind—almost reckless of the weight which it draws after it? How is a locomotive constructed? What is the nature of the difficulties in railroad making—and what the cost in any particular place? Can any one pass through the great tunnel on the Reading road, and learn that in carrying it through the mountain, the candles alone cost about $4000, without wishing to be informed of other particulars relative to time, labour, cost and contrivance? What proportion of those who travel know beforehand, that *canals*, as well as roads, have to be carried across rivers on *bridges*. exhibiting the phenomena of boats sailing over the topmasts of other boats? As one of the most rational objects in traveling is to add to the stock of our intelligence, it is surely of importance that every facility should be sought for, and one of the best of these is a good itinerary or guide book. It was on this account that we hailed with pleasure the appearance of the work before us. No one, we are persuaded, could have undertaken such a task with more of the true *gusto* of compilation than the author himself, already a veteran teacher of map geography, whose praise is in all the schools.

In a very suitable introduction to the statistical part of the work, it is justly remarked that:

"Whatever may be the condition of other portions of the civilized world with regard to these important modes of intercommunication, we, in this country, may boast of our superiority, not only in the extent to which the

* A Complete History of the Gunpowder Treason, A. D. 1605, by Rev. T. Lathbury, M.A

system has been carried here, but also in the admirable formation of its various lines; and, what is of infinite importance, in the structure and management of the locomotive engine. Among us, the spirit of improvement is no longer confined within the limits of our populous states, but, like their restless inhabitants, has found its way to the remotest corners of the republic, where its influence is equally felt and appreciated, and where the system will become as universal as it is beneficial.

"This general extension, actual and prospective, of canals and railways in the United States, is one effect of that enlightened constitution of government which the Revolution has confirmed to us, and which impresses an indelible mark of distinction between the enterprizing American and the plodding inhabitant of the other hemisphere. In most other countries, the great mass of the people, being destitute of wealth, have but little influence, and still less power to effect important objects; hence every work requiring large expenditure, must be accomplished by the wealthy few, whom it is well known do not always consist of the most enterprising portion of a community. Here it is essentially different; wealth and information being more generally diffused among the great body of the people, they possess and exercise a powerful influence in all affairs of a public nature, and of course claim a large share of attention. To the *people* of the United States, then, is the great system of internal improvement confided.—To this system, therefore, men of learning and influence now direct their attention, as the *people*, in the most comprehensive sense of the term, are to derive the advantages which must result from its general adoption."

The book is not confined to a description of the roads and canals actually in operation. Four of the great lines of intercourse which have been clearly marked out, and wait only the return of renewed commercial prosperity, are also very properly delineated, thus furnishing a more interesting view of what the country will be in the course of a few years of returning wealth and activity.

"The description of those works now offered to the public, differs in several points from other books on the same subject. Besides exhibiting an easy, distinct, and systematic account of the existing works of internal improvement, we have endeavoured to describe those merely contemplated, which are likely to be constructed soon. The value and importance of canals and railways depend on a combination of circumstances, which reciprocally affect each other. There is a nearer connexion between works situated apart and distant from each other, than most people seem to apprehend. In a work of this kind, the object of which is to develop the moral, political, and commercial effects of the system of internal improvement in our country, none of these topics should remain unnoticed. The omission of any one of them would, in reality, deprive us of a branch of knowledge, not only interesting in itself, but which is absolutely necessary to enable us to form a just conception of the subject in general. We have therefore thought it necessary that our work should embrace the history and present condition of the canals and railways in every state and territory of the Union, with the particulars and details belonging to each. This will, on reflection, appear necessary, when we consider the powerful influence of the system upon the habits and pursuits of a vast number of our people."

The "Introduction" is followed by a "General View" of the great system of internal improvement now in operation and in project throughout the country. A map of the United States, on a scale of convenient size,

exhibits to the eye the progress that has been made, as well as the roads and canals in different states of forwardness, and those which are still waiting for funds. Of the great routes, the author tells us:

"The first great chain of railroad, of which those just mentioned form a part, is that commencing at Portsmouth, in New Hampshire, and extending, with an occasional interval, through the Atlantic states to Pensacola, in Florida. From Portsmouth, the Eastern Railroad extends to Boston, whence the line is continued, by the Boston and Providence Railroad, to Providence, where it meets the railroad to Stonington, in Connecticut. From Stonington, after crossing Long Island Sound to Greenport, on Long Island, the line is resumed, and proceeds to Brooklyn, opposite New York, by the Brooklyn and Long Island Railroad, about 28 miles of which are completed and in use; the remaining 72 miles are now in progress. Crossing the East River to New York, and thence over the Hudson to Jersey City, the line is continued by the New Jersey Railroad to New Brunswick, thence by the Trenton and New Brunswick Railroad to Trenton, and thence to Philadelphia, by the Philadelphia and Trenton Railroad. From Philadelphia it proceeds to Baltimore, by the Philadelphia, Wilmington and Baltimore Railroad, and thence to Washington, by the Washington branch of the Baltimore and Ohio Railroad. The road from Washington to Fredericksburg, in Virginia, though proposed, is not yet commenced. At Fredericksburg the line is resumed and proceeds to Richmond, by the Fredericksburg and Richmond Railroad, thence to Petersburg by the Richmond and Petersburg Railroad, thence by the Petersburg and Roanoke Railroad, to Gaston, in North Carolina, thence by the Raleigh and Gaston Railroad to Raleigh, whence it is proposed to construct a railroad to Columbia, in South Carolina. From Columbia, by the Columbia branch of the South Carolina Railroad, the line is conducted to Branchville, and thence by the main line of the South Carolina Railroad, to Augusta, in Georgia. At Augusta commences the Georgia Railroad, which extends to De Kalb county, whence a road to West Point, on the Chattahooche, is in progress. From West Point the line proceeds along the Montgomery and West Point Railroad to Montgomery, in Alabama, and thence by the Alabama, Florida and Georgia Railroad, to Pensacola in Florida. In the entire length of this extensive line, there are but four sections wanted to render it complete, viz. one from Greenport to Hickstown, Long Island; one from Washington to Fredericksburg; one from Raleigh to Columbia; and one from De Kalb, in Georgia, to West Point. The aggregate length of these railroads, nearly all of which are completed, and in use, is 1600 miles. Should the state of Virginia execute her projected railroad from Richmond, via Abingdon, to the Tennessee line, a route to New Orleans will be effected by means of the Highwassee, Knoxville, and Nashville, and the New Orleans and Nashville Railroads, now in progress."

Connected with this great Atlantic line, are eight other routes of national importance, described in the General View.

"Thus, it will be perceived, that the entire surface of our country is now, or will be shortly, intersected by canals and railroads in almost every direction; and the West will ere long present a spectacle equally cheering to the friends of internal improvements. As facilities of intercourse, the moral effects of the general introduction of railroads and canals can never be duly appreciated. Considered as means of revenue, merely, it is doubtful whether they can be made to yield an interest equal to that derived from most other investments. With regard to the canals of any country, taken

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in the aggregate, their average income falls considerably short of the current interest of the country. Some of the canals of England, those of Coventry, Erwash, and Laughboro, for example, yielded in 1822, an average annual interest of upwards of one hundred and twelve per cent. on their cost; whilst others scarcely defray their ordinary expenses. The average receipts from the New York State Canals for the last three years, have yielded an interest on these of about eight per cent. And the principal Canals of Pennsylvania, for the same period, have produced nearly six per cent. The tolls for the last fiscal year, ending on the 31st October, 1839, were on all the canals $542,386 63; on railroads, (Columbia and Portage) $319,-622 88; on motive power, $280,123 53; total, $1,142, 633 04, which exceeds the annual aggregate of the preceding year, by $151,380 62. The railroads throughout the country will, no doubt, prove hereafter to be more productive than the canals; though, according to a statement drawn up by Mr. De Gerstner, the interest on the capital invested in railroads in 1839, does not exceed five and a half per cent. per annum."

Besides the general map of the United States, there is one of the State of New York, one of the State of Pennsylvania, and two others exhibiting profiles of the elevations and distances of some of the chief canals and railroads. The materials of the work are evidently drawn from the most authentic sources—the official reports of engineers, and other public documents.

We could have wished that the author had furnished his book with a few more state maps, especially of some of the larger members of the Confederacy. We are not, however, disposed to complain, inasmuch as the general map of the United States is on such a scale as pretty well to supply the deficiency.

But the volume before us is not intended merely, or even chiefly, as a guide book to the traveler, while on his journey. It is designed for the library—for satisfying the inquiries of all who wish to be well informed in relation to the internal improvements completed or in progress throughout the national domain; and we know of no other work so well adapted to the purpose. As a hand-book in traveling, it is perhaps rather too large—and besides, there are few travelers who set out on such extensive journeys as to need as a *vade mecum* a description of more than one or two of the great routes through the country. We still think, therefore, and have so expressed it in our Journal, that a person, qualified as our author is, would do a most acceptable service to the public, by publishing separate itineraries of each of the most frequented routes, accompanied with a *map of the road* over which he is passing, and detailing the most interesting particulars of its construction and of the places passed through. Such guides we think would find a ready sale, at the depots, and even in the cars on the route. The map should occupy one side of the page of the book, and might very well be engraved on wood, and printed in successive portions with the page.

Separate guide books, of the kind now suggested, would by no means supersede the utility of the valuable work under review, and we cannot conclude our notice of it, without observing, that in addition to its statistics of all the principal railroads and canals in the country, about 30 pages at the conclusion are very judiciously occupied with a "Glossary of the scientific, mechanical, and other terms employed in engineering,"—terms which, in these railroad times, must become, to those who would converse intelligibly, almost as household words. G.

Memoir on the Propagation of Heat in Liquids. By M. C. Despretz. (*Ann. de Chem. June*, 1839.)

After citing the experiments of Count Rumford, as described in his Essays, vol. ii., and those of Dr. Thompson, in Nicholson's Journal, and inferring, justly enough, that neither of them were at all decisive of the question, the author brings into view the better devised experiments of Dr. Murray, of Edinburg. In all preceding attempts to ascertain whether heat can be propagated downwards in a liquid column, the objection appeared to be valid, that in every appearance of an actual transmission downwards, the sides of the vessel might be the conducting medium, and not the liquid itself. To remove this doubt, Dr. Murray ingeniously thought of the scheme of forming a cylinder of ice, which of course is a perfect non-conductor of heat above 32° Fahr. His results have been considered as having satisfactorily determined the reality of a downward transmission of heat in liquids, and of course the conductibility of heat of bodies in the liquid as well as in the solid state.

But Dr. Murray's experiments did not determine the law of transmission, and this was one object in the experiments of M. Despretz. He remarks, that in a prolonged discussion, to which his researches had given rise, in the Philomathic Society, the name of Fourier had been invoked, and he cites the following paragraph of that "illustrious geometer":

"The coefficient which measures the proper conductibility of the mass (liquid) has not a value entirely null; but this coefficient is very small. We have very few experiments on this subject. Those which we undertook a few years ago, proved to us that liquids are not destitute of the property of transmitting heat, and that the various kinds possess this property in quite different degrees But it always appears to us, that the value of the coefficient is very small, so that changes of temperature are almost entirely determined in liquids by interior motions. The effect of communication is not null or almost insensible, as Count Rumford supposed, but it certainly has a very slow influence over the distribution of heat."

If heat be applied to the upper surface of a liquid column, the temperature of which is above that of the maximum density of the fluid, which, in the case of fresh water, is about 4° C. = $39\frac{1}{5}$ F., and it is found that the temperature increases downward, it is obvious that this cannot arise from evection or the motion of currents, and therefore there can be no question of the conductibility of the liquids, or the transmission of caloric from particle to particle, as in the case of solids. It was with a view to furnish another experimental proof of this fact, and also to determine the law, that the author instituted his inquiries.

His apparatus consisted of a wooden cylinder, about eight and a half inches in diameter, and 39 inches high. The bottom was of tinned copper, which was kept in contact with water of the constant temperature of the room. The thickness of the wooden side of the cylinder was about one inch and a quarter. Twelve thermometers were introduced into the axis of the vessel, horizontally, passing through holes in its sides. The reservoirs of the thermometers were about 2.8 inches in length—the upper one was at a distance of 1.8 inches from the source of heat, and the upper six were about the same distance from each other, while that of the other six was double. A vessel of thin copper, about 10 inches high, was placed on the upper part of the cylinder, into which, during the experiment, boiling water was in-

troduced by a tube proceeding from another room, and which was conveyed back again by another tube, the vessel being replenished with boiling water every five minutes, thus preserving the temperature of the heating source uniform, as well as that of the room of the experiments.

The experiment continued 32 hours, and at the end of 24 hours, the temperature of the whole column became stationary, and continued so to the end. The first six of the thermometers only indicated any rise of temperature, the next and succeeding not being affected.

The medium of the last six hours being taken as the statical condition of the column, the result of the experiment was as follows:—

Temperature of the room, 8°.78 C. = 47°.80 Fahr.

	Temperature.	Expanse of the air.
1st thermometer,	46°.37	37°.59
2nd do.	33 .10	24 .32
3d do.	23 .46	14 .68
4th do.	18 .30	9 .52
5th do.	14 .44	5 .66
6th do.	12 .23	3 .45

Several of the learned members of the Academy, who acknowledged the importance of these results, having expressed the fear that the envelope of the liquid column might have contributed to the propagation of the heat, M. Despretz was induced to repeat the experiment with a cylinder of nearly double the size of the former, namely, about 16 inches in diameter, with the addition of several thermometers placed very near the side of the tub, and three others with their reservoirs within the substance of the tub itself, in oblique cavities made for the purpose, and sealed up with wax.

The experiment continued 60 hours, and it was found that the temperature decreased from the axis of the column to the circumference, and from that to the interior of the wooden envelope, thus obviating the objection made to the former experiment, and evincing that little or no allowance was to be made for the conducting power of the tub. The heat descended farther in the large column than in the smaller, but the progression appears to have been at the same rate.

On comparing the progression with the formula given for the progress of heat along a metallic bar, M. Despretz finds them to be the same, and he thus sums up the conclusions deducible from his experiments:—

"1st. In a liquid cylinder, heated at the top, the heat is propagated so as to give an excess of temperature over that of the surrounding air, at equidistant points in the axis, which is in geometrical progression.

"2nd. The temperature in the same horizontal line decreases from the axis to the circumference, and from thence to the envelope, proving that the envelope had no effect on the heat of the liquid.

"3d. Experiments made with cylinders of different diameters, satisfy the law which connects these diameters with the quotients of the geometrical progression for solid bodies.

"The natural and necessary conclusion is, that the propagation of heat from top to bottom in liquids, takes place according to the laws which regulate its progression in solids, or, in other words, radiation takes place from particle to particle." G.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN SEPTEMBER, 1839,
With Remarks and Exemplifications by the Editor.

1. For an improved *Cooking Stove;* Hiram Root, Deerfield, Franklin county, Massachusetts, September 3.

This patent is taken for an improvement on the valves of the stove patented by Hastings and Sikes, and the claim is limited to "the mode of constructing the valves used for closing the openings in the bottom and sides of the risers, and at the same time consisting of circular plates with semicircular openings, surrounded by perpendicular rims, to which are attached coverings for the holes in the sides of the risers, and also handles projecting through the slits round the base of said risers, as above described."

It will be seen that the foregoing patent is taken for certain special devices applied to the particular stove above referred to, which was patented on the 23d of November, 1837, and which was noticed in its proper place.

2. For *Connecting Metallic Plates for Boilers, &c.;* Robert Smith, Great Britain, September 3.

This invention consists in "the employment of certain machinery for connecting the plates by compression, that is, compressing the ends of the studs, or rivets, by dies, instead of the ordinary manner of riveting by means of the hammer, and by manual labour." The riveting is to be effected by passing the plates between circular revolving dies, the construction and arrangement of which are represented in the drawings accompanying the patent, and which appear to be well calculated to accomplish the purpose intended. The patentee says that "boilers and other vessels, the plates of which have been connected by the means described, are much more firmly united, and consequently much more capable of resistance, than those which have been riveted in the ordinary manner by hand, and that the rivets so produced have a much more finished appearance and regularity of form than can be obtained by the ordinary strokes of the hammer, whilst the saving of time consumed in the operation is as ten to one." The claim is to "the manner of connecting metallic plates for the construction of boilers, and other purposes, by riveting them together by compression obtained by the aid of machinery constructed on the principles shown in the accompanying drawing, whatever variation in form or dimensions it may receive."

3. For a machine for *Sawing Staves;* Hart Pepper, Southworth, Hampden county, Massachusetts, September 3.

This stave-sawing machine operates by means of two revolving saws, each in the shape of a half barrel; and which saws are to cut from each end of a piece of plank, towards its middle. This mode of sawing is not new, and the novelty in the machine before us consists in the manner of fixing and actuating the two saws. The shaft upon which the saws are respectively affixed, and with which they revolve, is placed upon the end of an arm, or lever, the length of which is equal to the radius of the curve to be given to the staves lengthwise, and these arms are guided in simultaneously, whilst the saws, also, are made to revole, and cut the stave.

Claim. "I do not claim as my invention the form of the saws employed

in this machine; nor do I claim the sawing of staves from each end towards the middle; but what I do claim as my invention, is the giving to each of the saws a curvilinear, reciprocating motion, in the manner, and for the purpose, herein described."

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4. For a *Water Wheel;* William C. Bishop, Ovid, Seneca county, New York, September 5.

This wheel is called the Direct Inclined-Plane Reaction Water wheel; and the principal feature by which it is distinguished from other reaction water wheels, is its complexity. The buckets are in two tiers, placed between a middle and two outside plates; and there is no doubt novelty enough in the arrangement to justify the grant of a patent; and this is all that we feel warranted to say in favour of the invention. The claim is to "the arrangement of the upper, middle, and lower plates, with direct action buckets between the middle and upper plates, with the inclined-plane and reaction buckets between the middle and lower plates, as described."

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5. For a *Printing Press;* William Schnebley and Thomas Schnebley, Hagerstown, Washington county, Maryland, September 7.

The specification of this patent is of great length, with numerous references to the drawings which accompany it. The impression is made by a platten, raised and lowered by a toggle joint, and some idea may be formed of the parts deemed new by the inventors, from their claims, which are the following:—

"1st. The combination of two grooves on the cylinder for the purpose of giving the impression, and operating the carriage and inking rollers, as described. 2d. The arrangement of the ribs and bed by which the bed with the form of type can be removed for correction, and when replaced is stationary for the action of the platten, as described. 3d. The method of taking the papers from the frisket and discharging the same by means of the fingers attached to the platten, as described. 4th. The mode of discharging the papers after being impressed, below the feeding board, by the arrangement of the cords and weights attached to the frisket, as described. 5th. Supporting the frisket on springs attached to the carriage, in the manner described, and, in combination therewith, the springs attached to the platten forcing down the frisket, as described."

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6. For *Spooling Wool*; Zechariah Allen, Providence, Rhode Island, September 13.

This patent is obtained for "an improvement in that part of the process of manufacturing wool, which relates to the spooling of the filaments of rovings which are produced by the carding engines called *breakers*, and are used to supply the feed rollers of the carding engines termed *finishers*."

"This improvement is carried into effect by means of a spooling machine constructed for transferring the rovings of wool from the short spools on which they are wound by the breaker carding engines, to a single long spool, wherein a sufficient number of these rovings are combined from a continuous sheet, or lap, of a breadth adapted to that of the finisher carding engines, to which they are applied for the purpose of supplying them with the wool to be carded."

The claim is to "the arrangement of the spools and arbors or rollers, in combination with the cylindrical drum which sustains and gives motion to

the long spool; and the surface of which moves with equal velocity with the surface of the arbor, or rollers, all as described."

7. For a *Revolving Harrow;* Moses G. Cass, Utica, Oneida county, New York, September 10.

This harrow consists of four rollers revolving on gudgeons, the rollers being set with harrow teeth, and so placed as to constitute a square. The frame in which they run consists of two pieces of timber halved together at their middles, so as to form a cross, into the ends of which the gudgeons of the rollers are received. The harrow is to be drawn by one of the ends of the cross, so that each roller stands at an angle of 45° with the line of draught. The claim is to "the addition of two revolving bars, armed with harrow teeth, placed behind the two already in use, thereby forming a four-sided figure, in the manner described."

8. For *Regulating Motion in Machinery;* Frederick S. Bernard, city of New York, September 10.

This is a device for increasing the friction to any desired extent on the driving parts of such machinery as is to be propelled by the friction of the periphery of one wheel against another, instead of by cog gearing. There are no doubt certain parts of machinery to which the contrivance made the subject of this patent may be applied, but it is not calculated for general use as a substitute for cog gearing. It will be readily seen that if a gudgeon, or shaft, be made to revolve by the pressure of, or between, three friction rollers, and one of these has its bearing upon the shaft increased, the driving power, from adhesion, will be augmented.

Claim. "I do not claim as my invention the substitution of the friction of the surfaces of revolving bodies as a substitute for cog gearing, as this, I am aware, has long been known, but not employed in a manner similar to mine. I therefore claim as my invention the combination of the ring, wheels, and spindle, arranged as herein described, as a substitute for cog gearing, and also claim the method of increasing the pressure against the surfaces of the spindle, wheels, and inner periphery of the ring, by shifting the position of one of the wheels, in the manner described."

9. For *Cutting Shingles from Steamed Timber;* Daniel C. M'Millen, John B. Knoll, Thomas S. Henry, and Matthew Knoll, of the State of New York, September 10.

The claims under this patent are to the special manner in which the respective parts are arranged, which appears to be well calculated to produce the intended effect. We cannot, however, attempt to describe these parts.

10. For a *Double Mould Board Plough*; Ambrose W. Barnably, Ithaca, Tompkins county, New York, September 11.

The claims are to "the mode of changing a double mould board plough to serve either as a right or left handed one for hill side, and other, purposes, by shifting the beam and securing it on the cross piece, as described. Secondly, the attaching the coulter to the upright standard, or cutting edge of the mould board, by means of a clasp and stay, instead of to the beam, as set forth." The many ploughs of a similar kind which have been devised, leave but little chance for any great improvement, and, in fact, the differ-

ence in many of them is not substantial, but consists in mere alterations in the manner of shifting and fastening the beam, &c.

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11. For *Metallic Covering for the Roofs of Houses;* Peter Naylor, city of New York, September 11.

Bars of metal are to be attached to the rafters, and these bars are to be so bent as to form a succession of arches, or elevated ridges, to which metallic plates are to be riveted, in a particular manner. Thin bars of metal, placed edgewise, are to extend along these ridges, and the plates of metal used must be of sufficient width to extend from one of these thin strips to another, and so as to lap over, and to be riveted through them.

The claim in "the plan of constructing a metallic covering for roofs, is the manner of connecting the edges of the respective sheets together by lapping them upon, and riveting them through the bars of metal, whether placed upon arch pieces as first described, or directly upon the timbers, sheeting, or planking, or raised therefrom by battens, or strips of wood, or in any other way, whilst the construction and use remain substantially the same with those herein made known."

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12. For a machine for *Sawing, Cutting, and Jointing Staves;* Sumner King, Suffield, Hartford county, Connecticut, September 11.

This machine is one of that kind which saws, or cuts, the staves lengthwise of the grain of the stuff, there being a revolving wheel of such diameter as to correspond with the curvature of the stave lengthwise. There are, of course, certain novelties in the manner of arranging the respective parts, upon which to found the right to a patent. The following are the claims:—

"1st. The making the saws or cutters project below the plane of the motion of the wheel more at one end than at the other, so as to cut the stave through without feeding the block up to the saw, or saws, or depressing them to the block, in the manner described.

"2d. The method of jointing the staves by means of the two cutters attached to the jointed arms, and governed by the grooves, as described.

"3d. The mode of setting the timber from which the staves are cut, up to the saw, by the combined action of the racks, and the spring catches, worked by the arm, as described."

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13. For *Locks for Banks, &c.;* William Stillman, Westerly, Washington county, Rhode Island, September 14.

This lock is so constructed as that the continued action of two keys is required to shoot the bolt back and forth, there being, of course, two keyholes. The keys act upon opposite sides of the bolt. There are, also, to be what the patentee calls stoppers, within the lock, the nature and object of which we shall not take the time to describe, as it would require more space than we think proper to devote to it. The keys are of the ordinary kind, and the invention, we are apprehensive, is not such as to compete with locks previously in use, where special security is required. The claim does not designate the nature of the invention.

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14. For apparatus for *Making Known any Deficiency of Water in a Steam Boiler;* William H. Hale, Brooklyn, Kings county, New York, September 14.

This invention is intended for the purpose of sounding an alarm by the escape of steam through a tube, when there is any dangerous deficiency in the quantity of water in a boiler. Said tube leads into a metallic box, containing fusible metal, so arranged as that when the metal melts, the steam in the boiler can escape through an alarm tube. The particular arrangement made for this purpose forms the subject matter of the claim.

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15. For improvements in the *Odometer*; Smith Beers, Waterbury, New Haven county, Connecticut, September 14.

Odometers have been made, tried, and abandoned, many times, during more than a century; not because they have failed in indicating the distance traveled, but because they have been more objects of curiosity than of actual utility. We have seen some in use, but many more that had been used, and thrown by, sometimes because they were out of order, but more generally because they were no longer things of curiosity. The odometer before us will, no doubt, operate well, but the improver has probably learnt already, that his prospect of remuneration for his trouble and outlay, is but small. The claims, without an engraving, would not make known the peculiarities of arrangement in the present instrument.

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16. For setting and arranging *Sugar Kettles;* Maunsel White, city of New Orleans, September 17.

The claim under this patent is to "the carrying the flues from a single fire in two semicircular arches, under two sets of sugar kettles, arranged in a circle, for the purpose, and substantially in the manner described."

By this mode of arrangement, the patentee says, "a great saving of fuel is effected, room is economised, the operations are performed with greater facility and convenience than heretofore, and other advantages are attained." All of which appears probable, judging from the description and drawings.

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17. For an improved *Tooth Extractor;* John M'Connell, city of Philadelphia, September 20.

This patent is taken for an improvement on the Dutch key. "In this instrument, as ordinarily made, the hook, or claw, turns upon a joint pin above the bolster, or that part which forms the fulcrum of the instrument in the act of drawing a tooth. In my improved instrument, the hook, or claw, I sometimes make so as to turn upon a joint pin, as heretofore, for the purpose of placing it upon the tooth; but when so placed, it is to be prevented from turning upon its joint pin by means of a check lever, or spring latch, which is made to fall into a notch formed in the head of the hook for that purpose; and when so fixed, the instrument may be turned in either direction without loosening the hook, or claw, so that the latter may become the fulcrum upon which the instrument may turn in the operation of extracting a tooth; but instead of allowing the hook, or claw, to turn upon a joint pin, I sometimes make it with a shank which passes through a mortise in the head of the bolster, where it is acted upon by a pinion by which its claw end is drawn firmly against the tooth, when it is fixed in its place by means of a tightening screw, thus enabling a single claw to fit every tooth, whatever may be its size.

"I will here remark, that instead of the movable bits, with their points,

such points may be formed directly upon the bolster, but they will soon lose their sharpness, and will, therefore, be inferior to the movable bits.

"What I claim as my invention in the above described instrument, is the manner of confining the hook, or claw, in its place, by means of the spring latch, or lever, as described in the first modification of my improved instrument. I claim, likewise, the manner of constructing and operating the claw so that a single claw may serve for teeth of every size, by causing the shank of the claw to slide through a mortise in the head of the bolster, and be regulated and affixed by the rack and pinion, and the tightening screw, substantially as herein shown. I also, claim, in combination with the foregoing, the insertion of movable bits, furnished with points, on the sides of the bolster, in the manner, and for the purpose, herein set forth."

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18. For a machine for *Pressing and Napping Hats;* Andrew Rankin, city of Newark, New Jersey, September 20.

The claim under this patent will give a good general idea of the invention. It is as follows: "What I claim is the operating upon the hat bodies in the process of napping by double friction boards, between which they are placed upon rollers, furnished with suitable cloths lapped around them, as set forth. I also claim the employment of a single friction board in combination with a traversing carriage beneath, in which the rollers play, the bottom of the box operating as a second, or lower, friction board. And I do hereby declare, that I do not intend to limit myself to the precise form or disposition of the respective parts, as set forth, but to vary these as I may think proper, whilst I attain the same ends by means substantially the same."

The rubbing boards, and other apparatus above referred to, are contained in a closed box, into which hot water is to be pumped from a kettle, there being other devices also necessary to the conducting of the process.

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19. For an improved *Revolving Hay Rake;* Ephraim and Moses D. Wells, Morgantown, Monongahela county, Virginia, September 20.

After a very long description of this machine, we arrive at the following brief claim, namely, to "the manner in which we regulate the revolution of the rake by means of the handle, in combination with the catch plate, the cross bar, and the rod, as described."

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20. For an improved *Stove;* Eldridge M'Collum, Weare, Hillsborough county, New Hampshire, September 20.

By this improvement, "the ordinary open, or Franklin, stove, is made convertible into a close cooking stove, and combined with ovens on each side thereof, in such a manner as to combine economy in the use of fuel, with convenience in the application of heat, either for the purpose of cooking, or of heating apartments." The particular manner of directing and governing the flues, and of arranging the other parts, is not a matter for verbal description, we therefore pass it over.

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21. For a machine for *Setting Saws;* Joseph Beach and David Culver, city of Hartford, Connecticut, September 20.

The saw to be set is placed between two bars of iron, and wedged in place, with the teeth projecting over a bead along the lower bar. The set-

ting is to be effected by means of a hammer and punch. The claim is to this arrangement.

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22. For making *Pill, and other, Boxes*; Jacob Bentz, city of New York, September 20.

The subject of this patent is simply a machine for cutting thick shavings from blocks of wood, which shavings are subsequently to be united together by covering them with paper. The claim is to "the plane and stock having a rectiliniar reciprocating motion, with the press for holding the block, in the manner described." It would be very easy to make a machine to answer the purpose, and equally well, in all respects, with that represented, without interfering with the patent, as the machine does not present any thing of special originality.

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23. For a machine for *Setting Elliptic Springs;* George J. Neveil, city of Philadelphia, September 20.

This machine is for setting the plates of elliptic springs to the proper curvature; this setting is effected upon a bed of cast, or of wrought, iron, the upper surface of which has the ordinary curvature to be given to the spring, but for the purpose of increasing the curvature, the bed is divided into two parts by a cross section at its middle, and by raising this part whilst the ends are kept down, the set of the spring will be increased. The setting is effected by means of two rollers, which are attached to arms of the proper length, and working on joints below the bed, which arms may be raised or lowered when required. The steel to be bent is heated, laid upon the bed, and held down, when the rollers are to be passed over its surface.

The claim is to "the combination of the two beds, or forms, regulated as described, with the rollers attached to the levers, and governed by a lever and springs, for the purpose and in the manner set forth."

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24. For an improved *Sled, or Sleigh;* Daniel Carpenter, Nelson, Madison county, New York, September 20.

The object in view, in the contrivance which is the subject of this patent, is to enable the horse to hold back against the descent of a sled, or sleigh, in going down hill. The patentee states that the nature of his invention "consists in applying the power used to draw the sleigh directly at the bottom of the runners, or as near the place of friction, or resistance, as possible, and the power used in holding a sleigh back in going down hill over the sleigh, or in such a manner as that the tongue, or pole, used in holding back, shall incline to push down instead of up, in the act of holding back." The claim is to the combination of the pole, or perch, connected with the drawing apparatus, or lower part of the sleigh, with the one attached to the apparatus for holding back on the upper part of the sleigh, for the purpose, and in the manner described.

There are two poles, one proceeding from the lower, and the other from the upper, part of the sleigh carriage, one of them standing above the other, and these poles are loosely connected together at their outer ends, in such manner as that the change in the position of the sleigh will change the resistance, in holding back, from one of them to the other.

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25. For a machine for *Making Rivets;* Francis A. Cannon, city of Boston, Massachusetts, September 25.

This rivet machine has much novelty in the manner in which its respective parts are arranged, but we shall not now describe it, as, although not complex, it would still require the illustration of a drawing. The claim refers by letters to the individual parts.

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26. For improvements in the *Machine for Manufacturing Paper*; William Knight, Abijah L. Knight, and Edward F. Condit, Whippany, Morris county, New Jersey, September 25.

"In this machine, the paper is formed upon a revolving cylinder, the construction of which is similar to that of the cylinder now in use, but it is made considerably larger in diameter than those generally employed, and the paper stuff, or pulp, is applied to it in a manner different from that used in the other cylinder machines." The pulp is supplied from a pulp box, above the cylinder, and is fed to it through a gate, properly regulated. It is led off from the first cylinder, and passed between pressing rollers; and from these conducted around and between a succession of drying cylinders, usually ten in number, placed in pairs one above the other, so as to operate as pressing, as well as drying, cylinders. There are many points of arrangement which we pass over, and furnish the claims made, which are as follow:

"We claim the combination of the revolving bands with the cylinder for giving an even edge to the paper at each end of the cylinder, causing, by said arrangement, the said band to revolve by the cylinder itself.

"We claim the running of the paper cylinder upon an independent frame, resting upon rollers on a stationary frame, in such manner as to admit of a vibratory motion being communicated to said upper frame, and the parts appended thereto, as described.

"We claim the combining of the naked wooden roller, with the roller, for the purpose of collecting the broken paper, or pulp, as set forth.

"We claim the arrangement of the drying cylinders in a number of successive pairs, for the purpose of simultaneously drying and pressing the paper, as described."

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27. For a machine for *Cutting Round Tenons;* Charles Whitsitt, Connersville, Fayette county, Indiana, September 25.

This machine consists of a cutter with saw teeth, formed like a trephine, or trepanning instrument. This is to be guided by a centre pin, which is forced forward by a spiral spring, but which recedes into a socket, as the saw advances. The claim is to "the combination of the rotary saw with the centre pin, pressed out by a spring, as described."

This is rather an imperfect affair, as there is not any provision whatever for cutting away the stuff surrounding the "round tenon," so as to form a shoulder, and fit it for any purpose.

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28. For a machine for *Crimping Boots*; Horace Ferre, Springfield, Hampden county, Massachusetts, September 25.

There is not much novelty in this contrivance, but still it may be a real improvement. The patentee says, respecting it, that he does not claim the mode described of crimping leather, as this was patented by E. G. Pomeroy, on the 4th of October, 1836, but claims as his invention, the mode of attaching the leather to the plate, by combining with said plate, a plate, nut, and perforated screw, through which the straining screw passes.

29. For a *Steam Boiler*; Richard V. De Witt, city of Albany, New York, September 25.

"*Claim.* I do not claim, as my invention, the placing of a furnace, or of flues, within a boiler, nor do I claim the giving to the flues a scroll like, or spiral form, this having been done in the labyrinth boiler; but I limit my claim to the continuous diminution of the capacity of such a flue, for the purpose, and in the manner set forth, however the furnace may be situated, and whether the combustion be kept up by the ordinary draught, or urged by a fan wheel, or other blowing apparatus."

The boiler upon which this is an improvement, was patented by Mr. Van Order, of Ithaca, New York; his flue was scroll formed, but its section was the same throughout, the sides of the scroll having been parallel to each other. Mr. De Witt says: "but instead of keeping the sides thereof parallel longitudinally, I cause them to approach each other from the point at which the flue leaves the furnace until it terminates in the chimney, so that the space for the gaseous products of combustion undergoes a regular diminution. The object of this gradual contraction of the flue is to compress these products, as the gases contract by their loss of heat, by which contraction said gases are more effectually brought into contact with the walls of the flue than in the labyrinth boiler."

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30. For an improvement in *Mill Spindles;* Joseph C. Gentry, Dayton, Montgomery county, Ohio, September 25.

The mill spindle referred to is of the kind used in portable grist mills, which have stones of small diameter, usually of from twenty inches to two feet; and the improvements are in the manner of constructing the driver, and the oil box for the step of the spindle. The claim is to "the placing of the driver, or balance rine within a notch or opening in the upper end of the spindle, its lower end bearing on a fixed point, whilst its upper end is sustained by a point which is free to play to a small distance in the cap, as set forth. Also, the manner of forming the spindle step and oil box by means of the screw nut, washer, and cap, connected and combined with the step, and operating substantially in the manner described."

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31. For a *Road Leveling Machine:* John Scholder, Canton, Stark county, Ohio, September 25.

A scoop, or scraper, which is in form a concave semi-cylinder, is hung at its ends by two gudgeons to a frame, running upon wheels. The gudgeons are not in the centre of curvature of the semi-cylinder, but are near to its periphery, so that when the semi cylinder is made to move round on the gudgeons, by means of handles affixed to it for that purpose, its cutting edge will be thereby raised or lowered. This semi-cylinder is intended to operate in a way similar to that of the ordinary scraper. The carriage runs upon wheels, and has a tongue by which it is to be drawn forward. The claim is to the combination of the scoop attached to the frame, with the runners and lever frame, for the purpose of regulating the scoop, in the manner described."

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32. For *Squaring and Finishing the Heads of Bolts, Nuts, &c.*; John Bellemere, city of Philadelphia, September 25.

A chuck for a lathe is so constructed as that a number of screw bolts and nuts may be fixed in it, in such a manner as that by means of a slide rest one

side of each bolt, or nut, may be turned and finished. The mode of doing this, when once the idea is conveyed, will readily occur to any handy workman.

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33. For an improvement in the construction of *Lime Kilns*; A. H. Tyson, city of Baltimore, September 28.

Claim. "What I claim as my invention is the introduction of a vertical pipe in the centre of the kiln for increasing the draught. Also, the introduction of water to prevent the vitrification of the lime, by means of pipes, arranged as set forth. The constructing of the centre grate of the form described, so as to permit the ashes and refuse lime to slide down its sides and pass between the grate bars into the ash pit below. Also, the employment of the inclined doors for the discharging the lime."

The vertical pipe is suspended in the centre of the kiln, and is perforated with numerous holes at its sides, so that air passing into its open, upper end, may be diffused through the lime. This tube, as represented, rises to a small distance, only, above the kiln, and must, therefore, be in an atmosphere of carbonic acid, which would aid but little in promoting combustion.

Through the sides of the kiln there are a number of tubes inserted, which are furnished with stoppers, and through these tubes water is occasionally to be poured, which, it is said, will reduce any vitrified lime to powder, and cause it to fall down, and pass through the grate into the ash pit.

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34. For *Buoying up Ships, or Vessels:* John Brown, Stonington, Connecticut, September 28.

Along each side of the vessel to be buoyed up, there are to be placed eyes, or staples, to which rows of platforms extending out horizontally from each side of the vessel, at the water line, are to be securely fastened. Air-tight bags are passed along on each side of the vessel, under the platforms, or brackets, and when these bags are inflated by pumping air into them, the vessel will be buoyed up. The claim is to "the means and manner of securing the bags, or buoys, under the vessel, by means of the brackets, and other fixtures, as set forth."

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35. For improvements in *Pen Holders:* William Fife, city of Philadelphia, September 28.

This pen holder has an awkward appearance when first seen, but it is pleasant in use, affording much advantage in the management of the steel pen. The part which clasps the pen, and which is affixed to the end of the handle, is attached thereto by a slide which is a segment of a circle, of which the point of the pen is the centre, and whatever lateral slope may be given to the pen, its point does not change its place. The slit, as held, always corresponds with the downward stroke of the pen. The handle is not round, as in the common pen holder, but is made in such form as that where the thumb and middle finger press it in the act of writing, it is nearly flat, and considerably broader than the ordinary handle, and it is otherwise so formed as to be adapted to the fingers, and to take the proper position between them.

The claim made is to "the employment of a segmental piece, in the manner set forth, by means of which the obliquity of the slit may be easily varied in any required degree, whilst the point of the pen will not be thereby

removed from its coincidence with the axis of the handle, or with the centre of the circle of which said curved piece is a segment."

36. For a combined *Lifting and Forcing Pump:* Abraham Mixsell, Belvidere, Warren county, New Jersey; assigned to Peter T. and Daniel D. Campbell, Oxford, New Jersey, September 28.

There are some peculiarities in the construction of this pump, but without the drawings it would require too much space to make them known. The claim is to the particular manner in which the parts are arranged and combined, said parts being referred to by letters.

37. For a *Cocoon Lodgment:* Solomon M. Jenkins, Easton, Talbot county, Maryland, September 28.

The claim made is to a "double frame, the lowermost of which is divided into spaces by means of slats, and twine, or other suitable material, with pins descending from said slats, constructed as set forth." The arrangement of this apparatus appears to be such as to adapt it well to the convenient spinning by the silk worm, and the ready removal of the cocoons.

38. For an improved mode of *Tilting Cars and Wagons:* Jason C. Osgood, Chittenango, Madison county, New York, September 28.

The claim is to the employment of a traveling roller, so constructed as to catch upon the tilting hooks, and retained by the guides attached to the cross bars, in combination with the body and car, or wagon, frame, as described.

39. For a *Press for Cotton, and other Articles:* James R. Hitchcock, and William F. Sewell, city of New York, September 30.

The description of this press extends through nine pages of record, with references to thirteen different figures in the drawings. The claims, also, refer, throughout, to these drawings, and we are compelled, therefore, to dismiss this matter without an attempt at description, which we must fail in making clear.

40. For *Double Seaming Tin Plate*; Hiram Van Pelt, and Benjamin Armstrong, city of Troy, New York, September 30.

The object of this invention is to double seam the bottoms, or heads, of cylindrical vessels, which is effected by means of rollers operating in the manner of those now in use for seaming such work. To fit them for this purpose, the rollers are so changed in form as to effect the double seaming, and the patentees say that they "do not claim the groove described, on the upper roller, that having been in use; but we claim the inclined plane surface, taken in its crosswise direction, extending round the said upper roller, as described, and substituted for said groove, in order that as the double seam is finished by the pressure of the lower roller thereupon, its greatest pressure shall be at its outer edge."

41. For an improvement in *Force Pumps*; Thomas W. H. Moseley, Paris, Bourbon county, Kentucky, September 30.

In this pump, when placed in a well, the chamber and valves are to be entirely under water; and there are two rods which extend down from the brake, and are attached to the opposite ends of a vibrating lever with equal

arms, to one end of which lever the piston rod is also attached. The two rods are jointed to the brake at equal distance from its fulcra. By this arrangement, the rods extending down from the brake operate upon the lower lever by tension, and may therefore be small. There is also a device for letting the water out of the ascending main, to prevent its freezing. The claim is to "the manner in which the rods, operating by tension, are combined and arranged with the lever, the brake, and the piston rod, so as to actuate a force pump, situated entirely below the surface of the water in a well or other reservoir; the parts being so arranged in other respects, in the manner set forth, as effectually to prevent the freezing of the water."

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42. For a *Cooking Stove*; Noble Peck, Carmel, Putnam county, N. York, September 30.

Any new cooking stove must, to a certain extent, nearly resemble many others, and we need not say, therefore, that such is the case in the present instance. What is supposed to be new is of course contained in the claim, which relates entirely to the manner of arranging the parts connected with the hearth and ash pit.

"The invention claimed consists in constructing the vertical part, or front plate of the ash pit, with openings for admitting air, regulated by a grated valve, in combination with the grated hearth over the sunken hearth, so that coals on the back of the hearth may be brought to the front, and a gridiron placed thereon for broiling without the coals being extinguished, as a draught of air will pass through the front of the ash pit to the coals, and thus continue the combustion."

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43. For *Preventing Steam Boiler Explosions*; Isaac N. Coffin, city of Washington, September 30.

"The nature of my invention consists in the so adapting of a float within the boiler to a valve, escape tube, rotary engine, and pumps, as that by the lowering of the water in the boiler, and the consequent depression of the float, a portion of the steam shall escape, and in so doing, shall give motion to the rotary engine, and through this to a pump, or pumps, for supplying the boiler with water." The claim is to this arrangement.

We believe that few, if any, practical engineers would deem an engine boiler secure from explosion, where the action of a float within the boiler was intended to produce the effects thus anticipated from it.

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44. For an improvement in the *Wheat Fan*; Alfred Edwin, Jefferson, Frederick county, Maryland, September 30.

There have been many patents taken for improvements on the wheat fan, or fanning mill, most of which are for trifling changes in the manner of arranging certain parts of it, without essentially altering its construction in any one point, and indeed it does not seem to require this. In the present case, the claim is to the "having openings in the sides of the fan case for the screen to extend through, and vibrate horizontally therein, and in attaching to the bottom or shoe of the hopper an additional board, extending horizontally over the whole length of the screen, to be used when cheat is to be separated from grain."

Specifications of English Patents.

Specification of a patent granted to George Nelson, *of the county of Warwick, for his invention of a certain new or improved process or processes, by the use of which the qualities of a certain gelatinous substance or gelatinous substances, called isinglass, may be improved.*—[Sealed 22d May, 1837.]

The gelatinous substances employed, according to this invention, are the impure and inferior sorts of isinglass, commonly known by the names of honeycomb pipe or tongue block, lump samony book, and samony leaf. These substances are more impure and much less soluble than the best sort of isinglass, imported into this country under the name of Russian leaf and staple, which is in itself, as imported, so pure as not to require any further operation.

The impurities contained in the first-mentioned articles are bits of skin and flesh and other extraneous matters, which are not easily dissolved. The substances to be employed should be cut into thin pieces, if necessary, and subjected to the process of maceration for twenty-four hours, if the substances are thin; but, if in lumps of any considerable thickness, they may be left in the macerating vessels for from two to six or eight days, according to circumstances. In this process they are subjected to the action of a solution of caustic alkali, consisting of two parts of potass or three parts of American pearlash, one part of freshly-burnt lime, and thirty parts of water.

It is easy to determine when the matters have become sufficiently macerated, by means of a fork or other suitable instrument. When this is correctly ascertained, the gelatinous substances should be removed in wooden trays or sieves, and piled one on the other in a suitable vessel, for the purpose of being washed;—this vessel is furnished with supply and waste pipes, the former of which allows water to flow into the top part of the vessel, and the latter draws it off.

The washing operation should be continued for two or three days, or until all the alkali is entirely removed. The gelatinous substances are then to be placed in a close closet, of the ordinary construction, and subjected to the action of sulphurous acid gas, obtained from the combustion of sulphur, within the closet. After this operation has been continued for a sufficient length of time, the gelatinous substances must be again washed to remove the sulphur, after which they should be dried by a draft of cool dry air,—the temperature of sixty or sixty-five degrees of Fahrenheit is preferred for this operation; the isinglass thereby produced and purified is then fit for use.

The patentee does not claim, as his invention, any of the processes or operations above described, as applied to gelatinous substances in general, but confines himself to the application of caustic alkali to the several gelatinous substances, called isinglass, that are mentioned in the commencement of the specification, that is to say:—the inferior or impure descriptions, known by the names of honeycomb pipe or tongue block, or lump samony book, and samony leaf, for the purpose of rendering the same more pure, more soluble, and more generally useful, than they are in the state in

which they are imported into this country. It being already observed, that the superior isinglass, as for instance, the best Russian leaf and staple, possesses these qualities without the aid of this invention.

Lond. Jour. Arts & Sci.

Specification of a patent granted to John Woolrich, *of Birmingham, in the county of Warwick, for an improved process for manufacturing carbonate of lead, commonly called white lead.*—[Sealed 11th October, 1838.

This invention appears to be an improvement upon Torrassa,—Muston and Wood's patent for making white lead. In the latter, white lead is produced by the friction of small pieces of lead rubbing against each other in a vibrating or rotary frame. The oxide thus produced is turned into a carbonate by the action of the atmosphere. It will, therefore, be perceived that white lead is produced mechanically, and not by the aid of acid solutions.

The present invention is for producing oxide of lead by mechanical means, with the assistance of certain acid solutions, and the product being acted upon by carbonic acid gas, becomes carbonate of lead.

The patentee describes his process in the following manner:—The ordinary lead of commerce is divided into small pieces, about the size of shot or grains of barley, in any convenient manner, such as by melting it and running through a metallic sieve into water. A quantity of lead, so reduced, is placed in a cylindrical or hexagonal vessel, made of lead or earthenware, having a hole in the centre of each end, about one-sixth the diameter of the vessel. The small pieces of lead in the vessel are then moistened with the following acid solution, viz.—protoxide of lead, dissolved in dilute ascetic acid, in such proportions as completely to neutralize the acid, and cause the solution to be of the specific gravity of 1.60. The apparatus being thus prepared, and the cylindrical or hexagonal vessel being mounted in a horizontal position; rotary motion is given to the said vessel, and the lead therein contained is kept continually moistened with the solution.

The rotary motion given to the vessel keeps up a continual friction amongst the pieces of lead, and which, assisted by the solution, causes very minute particles to be detached therefrom, and form a product which may be easily removed by washing. The product thus obtained is removed every twelve hours, and fresh quantities of lead, moistened in the manner above mentioned, are added, so as to keep up the original quantity in the vessel.—This product, and the fluid used in washing the same from the rotary vessel, are placed in another vessel, closed and kept constantly stirred by a spindle, which is moved round in the vessel. A stream of carbonic acid gas, obtained from a charcoal fire, is passed through the vessel, and the result will be carbonate of lead, or white lead, suspended in a liquid.

The lead is easily separated from the liquid by allowing it to settle for a few hours, when the carbonate, by its own gravity, will sink to the bottom, when the supernatant liquid may be drawn off by a syphon, or the carbonate of lead may be separated by filtration. It is then dried, when it will be fit for use.

The patentee here observes, that other solutions may be used, if preferred, viz.—a solution of protoxide of lead, dissolved in dilute nitric acid; or a solution of acetate of lead, in water; or a solution of carbonate of

potash, or carbonate of soda, in water; or a solution of nitrate of lead in water; dilute solutions of ascetic acid, or nitric acid, may also be used without being previously combined with protoxide of lead.

The hexagonal vessel should be about five feet long and twenty inches in diameter, with a round hole of from three to four inches in diameter, exactly in the centre of the ends thereof. About eight or ten hundred weight of lead, prepared as aforesaid, is a sufficient charge.

The patentee claims the use of all the solutions named, in combination with metallic lead; but he does not claim, as his invention, the mode of reducing the ordinary lead of commerce to pieces of such size as will render it available to the objects of the invention; nor does he claim the mode of obtaining carbonic acid gas from charcoal, as aforesaid; but he claims, as his invention, "the forming, from the friction of the ordinary lead of commerce, moistened with any such solutions as hereinbefore mentioned, a product which may be converted into carbonate of lead, or white lead, by passing carbonic acid gas through such product, and then separating and drying the product so obtained, which is thereby converted into carbonate of lead, or white lead." Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

On the comparative advantages of Long and Short Strokes in Steam Engines.

In our last volume, some discussion took place upon the advantage of long and short strokes in steam engines, without any satisfactory conclusion being arrived at. We have now the pleasure of extracting the following excellent paper illustrative of this subject from a very able pamphlet by Mr. John Seward, C. E., (printed for private circulation only) in which this question is treated in all its bearings, with consummate skill and practical acumen. We shall have the gratification of drawing further upon this source in subsequent numbers, meanwhile we commend the present extract to the careful perusal of our readers:—

A popular notion has for a considerable time past prevailed, that a long stroke engine is much superior to a short stroke engine; and it will consequently be found that the practice of most, if not all, engineers, is greatly regulated by this idea. On very careful consideration, however, it does not appear that this alleged superiority can be satisfactorily proved. That a long stroke engine, under certain circumstances, may be much more advantageously employed than a short one, is undoubtedly true, but considering the steam engine *per se*, that is, without reference to adventitious or extraneous circumstances, it would be difficult to show that the former has any advantage whatever over the latter.

For let a careful comparison be made of a long stroke engine with a short stroke engine; let there be two beam engines of thirty horses power each, both equally well made, but the one having a stroke of eight feet, while the stroke of the other is only four feet, the cylinder of the latter being double the area of that of the former; it being understood that both engines shall make the *same* number of revolutions per minute; the steam passages and valves to be of the same area and capacity; and the two engines in all other respects to be well proportioned and made without any limitation as to space or weight.

Now as regards the mere mechanical effect of the moving power, (*i. e.* of the steam) it is perfectly clear that it must be precisely the same in both

engines, because the same volume of steam must produce the same mechanical effect, whether it is let into a long narrow cylinder or into a short wide one; therefore, if there be found any difference in the efficient duty or economical working of these two engines, that difference must arise from circumstances quite unconnected with the mechanical effect of the steam power.

The only circumstances which really can make any essential difference in the efficient duty or economical working of these two engines are these —First, the greater or smaller quantity of friction in the various parts of the machines. Second, the greater or lesser radiation of heat from the cylinders and passages; third, the greater or smaller loss of steam by the clearance of the piston at the top and bottom of the cylinder. Fourth, the *inertia* and the impulse of the parts of the machine in motion on the surrounding air.

First, then, of the *friction*. It will be found in the working of a well made engine of the proportions of the short stroke engine under comparison, that more than four-fifths of the whole friction are due to the packings of the piston and air pump bucket, and of the piston rod and bucket rod,* and less than one-fifth to the main gudgeons, the end gudgeons, the crank pin, and other moving joints about the engine. But the friction of the piston packing will vary as the circumference of the piston, multiplied into the distance which the piston travels. Now in the long stroke engine, the piston, supposing it to be 30 inches diameter, will move eight feet, and the friction of the packing be therefore as 24, while in the short stroke engine the piston will be about 42.4 inches diameter, will move only four feet, while the friction of the packing will be only as 17. In the same way, it can be shown that the friction caused by the packing of the air-pump bucket, of the piston rod, and of the bucket rod, is also respectively in the ratio of 24 to 17 in the two engines. With respect again to the friction due to the main and end gudgeons, &c., it is clear that it will be less in the long stroke engine, because in the latter engine, the force acting upon these parts will be one-half what it is in the short stroke engine. Assuming, therefore, 100 to be the whole quantity of friction in an ordinary engine, then 80 of these parts in the short stroke engine will be due to the piston, air-pump, bucket, &c., while in the long stroke engines the friction of these parts will be as 113, that is $= \frac{24}{17} \times 80$, but the friction on the main and end gudgeons in the former engines will be as 20, and in the latter only 10, making the total friction in the short stroke engine 100, and in the long stroke engines 123, or one-fourth more.

Second. The *radiation of heat* will be in proportion to the extent of the surface, but the surface of the long stroke cylinder is much greater than that of the short cylinder, whence it follows that the loss by radiation in the former, must be greater than in the latter.

Third. The *clearance of the piston* at the top and bottom of the cylinder, which will evidently be greater in the short stroke engine than in the long stroke engine. Because the area of piston in the former is double that of the latter, some persons would be disposed to say that the loss by clearance in the former must be double what it is in the latter. But this is not quite certain, for it is not required to give so much clearance in a 4 feet stroke cylinder as it would be advisable to give in an 8 feet stroke cylinder, the

* The friction of the slide is not included, as that will obviously be the same in both engines.

reason of which is obviously that the spring and elasticity of the parts in the long stroke engine must be much greater than in the short stroke engine, and that they must therefore require more clearance. However, it is probable that there would be more lost in the latter engine than in the former.

The loss of steam by filling the passages and nozzles, as also by the radiation of heat from those parts, must evidently be the same in both engines.

Fourth. *The inertia and impulse of the moving parts on the surrounding air.* The loss in a steam engine occasioned by these two causes may not be very considerable; indeed as regards what is called the *inertia* of matter in the moving parts, it is doubtful whether any such source of loss really exists; however if it does exist, it is clear that the amount of loss must vary in proportion to the *momenta* of those parts of the machine which are in motion, but as the *momenta* must be as the mass of matter in motion multiplied by the velocity, and as these are evidently much greater in the long stroke than in the short stroke engines, (because the parts in the former are, if anything, of greater weight than in the latter, and also move at a double velocity) it follows that whatever loss may arise from the *inertia* must be much greater (double?) in the long stroke engine than in the short stroke engine. With regard to the loss occasioned by the impulse of the moving parts on the air; it must be admitted that in very slow motions it cannot be very important; nevertheless with a material increase of velocity this source of loss becomes serious; it varies as the extent of surface of the moving parts multiplied into the *square* of the velocity. It is tolerably manifest, however, that the surface of the moving parts in the long stroke engine will be, if any thing, greater than the short stroke engine, and that the velocity of the former will be twice that of the latter; therefore, the loss by impulse on the air in the long stroke engine must be four times that in the short stroke engine.

Beside the foregoing causes, it is doubtful whether there are any others that can produce any material difference in the efficient duty or economical working of a steam engine, at least none that can in any way influence the question now under consideration. In estimating, therefore, the advantages of the short and long stroke engines, we have in favour of the former a diminution of loss occasioned by friction, by radiation, by *inertia*, and by impulse on the air; while on the other hand, we have in favour of the long stroke engines, a diminution of loss in the clearance of the piston at the top and bottom of the cylinder. It may be difficult to strike an exact balance between these several sources of loss; but there can be no doubt that in a steam engine the loss by friction is much greater than the loss by all the other causes before mentioned put together; and it is past dispute that the balance of loss as regards these causes, is decidedly against the long stroke engine. (The advantages offered by the short stroke engine as regards diminution of space and weight, although of vast importance, are not here adverted to, because they form no part of the immediate inquiry.)

It may be objected, that to select an engine with an 8 feet stroke, and a cylinder of only $2\frac{1}{2}$ feet diameter for comparison, is not a fair proceeding, because an engine of such proportions is unusual; and it may be also asked whether, if the principle is further extended by making the stroke only 2 feet, and again doubling the area of the piston, whether the advantage would still be in favour of the short stroke engine?

To this it may be answered, that although an engine of 8 feet stroke and $2\frac{1}{2}$ feet diameter of cylinder, may be unusual in this country, it is not so in

America; in that part of the world many engines are employed of very nearly the above proportions, for purposes of steam navigation; and in which engines it is not unusual for the piston to travel at the rate of 300 or 400 feet per minute. Again, as regards the carrying out of the principle by still further reducing the length of stroke, say to two feet, and increasing the diameter of cylinder proportionately, say to five feet; there is no doubt whatever that such an engine would have precisely the same mechanical effect as either of the other two; but the balance of advantages would be against an engine of such proportions, because it would be verging to an extreme on one side, as much as the 8 feet stroke engine may be thought extreme on the other side. It may, however, be safely affirmed that the principle applies most powerfully to the case where the diameter of cylinder is the same as the length of stroke, because in that case the proportions are most favourable for the diminution of friction and of radiation, and offer the minimum of disadvantage under the several heads of loss above enumerated.

As it is manifest, therefore, that in all particulars which more immediately affect the beneficial employment or working of a steam engine, the long stroke has no manifest superiority over the short stroke; it may appear strange that so decided a preference should have hitherto been given to the former by the generality of engineers. Perhaps this is chiefly to be attributed to the circumstance of the long stroke offering, on most occasions, greater convenience than a short stroke. Much may be due also to fashion. The earliest application of steam power was for the purpose of pumping water in the course of mining operations, and in this sort of work a good long stroke was found to be attended with considerable convenience and advantage. In blast engines, and many other of the earlier applications of steam power, the same result was manifest; the earlier habits and ideas of engineers were therefore naturally associated with long stroke engines. Moreover, the earlier manufacturers of steam engines had neither good machinery nor good workmen; they could neither depend upon the correctness of their proportions nor upon the exactness of the workmanship; besides, timber and other inefficient materials were formerly employed to a considerable extent in the construction of engines; from all which causes, imperfections and irregularities were numerous in the earlier engines, and they were consequently very inefficient. As all these sources of imperfection and inefficiency operated much more extensively against short stroke engines than against long, it is no wonder that the latter soon obtained a preference, and that the prejudice should still continue to exist, notwithstanding the same causes are no longer in operation. At the present day, with our good materials and workmanship, exact proportions and adjustments, a short stroke engine will be found to work as accurately and as perfectly as a long stroke engine.

There is one very important circumstance to be kept in view as regards long and short stroke engines; which is, that whenever an engine of the latter description has hitherto been made, it has always been considered necessary to keep the cylinder nearly of the same diameter as in the long stroke engine, and to cause the engine to make a greater number of revolutions in proportion to the shortness of the stroke, so that the piston, in every case, might travel at a nearly uniform speed of about 200 feet per minute. Now, to a short stroke engine, made on this plan, there may undoubtedly be many objections. The more frequent alternation of the stroke—the greater loss of steam by the more frequent filling of the passages and noz-

zles, and the clearance at the top and bottom of the cylinder—the much greater angular motion of all the bearings and moving joints, thereby materially increasing friction and wear—are all circumstances tending to lessen the efficiency of a short stroke engine made upon this plan. It is clear, however, that an engine made upon the principle hereinbefore laid down, is not open to the same objections.

And, as regards the speed of the piston in engines, whatever may be the length of stroke, being regulated to the uniform standard of about 200 feet per minute, there can be no valid reasons given for such rule; no one can prove that double the above speed, or only one-half that speed, might not be employed with equal or greater advantage; it is certain that in many steam engines of the transatlantic world, the pistons move at a speed of 300, 400, and even 500 feet per minute, and no substantial reason can be assigned why such engines should not do good duty; indeed it may be safely affirmed that whether the speed of an engine be 100 feet or 200 feet, or 300 feet per minute, it matters nothing; provided all the parts of the engines are well proportioned for the proposed speed, the efficient duty and economical use of the engine will be much the same, keeping this always in mind, that the *slow speed will be more favourable for the easy and pleasant working of the engine, and for durability.*

This question may, however, be asked—Since it is shown that the long stroke has no superiority over a short stroke, but, on the contrary, that the balance of advantage is rather in favour of the latter, is it intended to recommend the invariable adoption of a short stroke engine, to the total exclusion of a long stroke? By no means. All that is contended for is, that in every case a length of stroke should be adopted, whether long or short, that shall prove to be most convenient, and best adapted to the object for which the engines are to be employed; and that an engineer should not be fettered and cramped by any fallacious abstract notions, that what is termed a long stroke engine must necessarily be more efficient than an engine with a short stroke; and that he should not therefore be obliged to sacrifice many other far more important considerations for the sake of obtaining, in every case, the longest possible stroke.

The application of steam power for the purpose of navigation has had such wonderful results, the character of the steam engine has become so greatly changed, and the proportions so altered, that a marine engine of the present day, and a land engine of former times, can scarcely be recognised as belonging to the same class of machines. The length of stroke of marine engines is probably not more than half what used formerly to be given to engines of similar power for mining and manufacturing purposes, but still no one can say that this departure from old rules and maxims has been attended with any disadvantage; on the contrary, it can be shown to have been most beneficial and glorious in its results; and if a still further departure from old established notions can be proved advantageous for steam navigation, we have no reason whatever to regret the change.

There is no question that the ordinary beam engine as employed in steam vessels, has proved most efficient, and that in its application it has been productive of vast benefit. If, however, by a modification of the existing steam engines, these benefits can be still further augmented, and that in an eminent degree, no consideration ought to stand in the way of the proposed improvements. The great and paramount objects to be aimed at in the construction of steam engines for navigation are the following, viz. the greatest saving of fuel, the greatest saving of space, the greatest saving of weight,

and the greatest durability of the machinery. The more eminently the marine engine shall combine the above important qualities, the more nearly will it have arrived at perfection; and much as may be advanced in favour of the beam engines generally used for marine purposes, it cannot be considered presumptuous to declare that the system of engines employed in the *Cyclops* and *Gorgon* frigates, is far superior in all the qualities before enumerated.

It only remains to be stated, that the real question is, not whether the stroke of an engine shall be 8 feet or 4 feet, but relates to a difference of stroke of probably from 7 feet to 6 feet; that is, whether the reducing of the stroke of a 200 horse engine *one foot*, with a proportionate increase of diameter in the cylinder, can be attended with such injury and inefficiency as shall wholly neutralize or outweigh all the important advantages of the Gorgon engines.

In conclusion, it should be observed that as regards the ordinary beam engines, there are many circumstances of convenience which render it advisable to make the stroke as long as practicable, *i. e.* the adopting of a tall narrow cylinder instead of a short and wide cylinder; for in the arrangement of the ordinary beam engine for marine purposes, it is evident that a considerable space lengthways is required for conveniently placing the slide jackets and passages, the condenser, the hot-well, and the air-pump; this necessarily causes a great elongation of the side levers, or beams; there is, therefore, much local convenience in making the stroke long, and thereby having a tall narrow cylinder instead of a short wide cylinder, less strain is thrown upon the beams; the beams become more close and compact, and afford more space for a passage between and on the off-sides of the pair of engines; the cross-heads and fork-heads become shorter, and have much less strain thrown upon them; these are all very important considerations, which clearly indicate the convenience and positive advantage of having as long a stroke as possible in the ordinary beam engine. But in the Gorgon engine none of these considerations have any weight whatever; here there are neither beams nor cross-heads; we can increase the diameter of the cylinder to almost any extent without any local inconvenience whatever.

We shall conclude these observations with the remark, that as it cannot be proved that there is any superiority in a long stroke engine over a short stroke engine, and as it is also evident that there is no disadvantage whatever in employing a short connecting rod, it is therefore clear that the two objections are decidedly absurd and groundless. Mech. Mag.

On Horn and Tortoiseshell. By A. Aikin, *late Secretary of the Society of Arts, London.*

The subject of the present evening's illustration is the manufacture of horn and tortoiseshell, to which I shall add some particulars respecting whalebone—a substance which, in its physical and chemical properties, bears a great resemblance to horn.

In the English language we have only one word to express two quite different substances—namely, the branched bony horns of the stag genus and the simple laminated horns of the ox genus, and other kindred genera.

The bony horns are called in French *bois*, from their likeness to the branch of a tree: they are annually renewed, and are peculiar to the male sex, ex-

cept in the reindeer, the females of which likewise have horns, though not nearly so large as those of the male.

The other sort of horn, to which the French appropriate the term *corne*, and which is the subject of our present inquiry, is found in the ox, the antelope, the goat and sheep kinds. These are never branched or palmated, but are always of a simple conical figure, more or less curved, and, in some of the antelopes, spirally twisted: they are found in both sexes, but, in the goats and sheep, are much larger in the male than female.

In all these animals, a bony core, of a loose texture and conical figure, rises from the bone of the forehead, covered by a permanent vascular membrane, from the surface of which are produced or secreted thin layers of horn in constant succession. It is supposed that one layer, or rather one set of layers, is produced every year; but, as the former layer remains closely adherent to the new one, such horns are permanent, lamellar in texture, and exfoliate only very slowly from the outside by exposure to weather and friction. The structure of such horns is that of a number of cones or sheaths inserted into one another, the inner of which lies on the vascular membrane that covers the bony core or base. The tip of the horn—namely, that part which projects beyond the core—is very dense, and the layers of which it is composed can hardly be distinguished, whereas the lower parts are of a looser structure, and the layers may readily be seen from the successive terminations of them forming prominent rings, which are very observable on the lower part of the horn. Horn itself is quite insensible, like the finger-nail; and therefore the tip may be cut off while the animal is alive without giving any pain; but if the section is made so low down as to include any part of the core, blood follows, and the animal seems to suffer greatly.

But it is not merely in the defences projecting from the forehead of the genera already mentioned that horn occurs: in the form of nails, claws, or hoofs, it protects and arms the extremities of the toes in all warm-blooded animals, and constitutes the leg-spurs of the cock and other gallinaceous birds. In the form of scales it covers the body of the pangolin, of the armadillo, of the lizard and serpent tribe, and of most fishes, and incloses the tortoises in a kind of plate-armour. It also supplies the hairy covering of the land mammalia, from the fine down of the beaver to the bristles of the wild boar, the horny hair of the elk and the musk, and the spines of the hedgehog and porcupine. The horn of the rhinoceros is not formed upon a bony core, but is merely an aggregation of flattened hairs or bristles adhering by their sides, and presenting longitudinal pores or interstices of considerable magnitude at the base of the horn, and which become smaller towards the point; these interstices in the live animal are filled with a pulpy matter. All feathers likewise, from the plumes of the ostrich to the quills with which we write, and the wing-spurs of the cassowary, are only modifications of horn; so that it may be considered as the general covering of the most highly organized animals.

Horn also occurs where it would not at first be looked for, in the form of plates hanging down from the palate or roof of the mouth in the Greenland whale, and in those others cetaceous animals that are destitute of teeth. This modification of it goes by the common name of whalebone, of which I shall speak more at large hereafter.

The membraneous parts of the animal body are also exceedingly similar to, if not identical with, horn, both in structure and chemical composition: such are the cuticle or scarf-skin which covers the whole body, and separates from the true and sensitive skin on the application of a blister. The

intestines, the bladder, and other thin parts which, on drying, become hard and transparent, are also of the same kind; as likewise are the air-bladders of fish: but these latter also contain jelly.

Certain animal fluids also bear a close analogy to horn in their chemical composition: such are the serum of blood and the white of egg. Both these substances coagulate at a heat less than that of boiling-water, and when afterwards dried, at the common atmospheric temperature, become yellow, transparent, hard, and bear a perfect resemblance to horn, except that their texture is compact, not laminated.

To all the substances above enumerated, chemists give the general name of albumen; and it is distinguished by the following properties from jelly and from fibre, the two other principal organic elements of animal bodies. It does not dissolve in boiling water and fix, on cooling, as jelly does, and by its long resistance to putrefaction it is distinguished from fibre. I may also mention that, when exposed to a decomposing heat in close vessels, it produces a large quantity of that gaseous compound which forms the base of prussic acid; on which account it is that hoofs and the refuse parts of horn are in great request among the manufacturers of Prussian blue.

Almost the only kinds of horn that are the subject of manufacture are those of the bull and cow, and the hoofs of these animals; the horns of the bullock being thin, and of a very coarse texture, are used only for the most ordinary purposes. Our domestic supply is by no means equal to the demand, so that great quantities are imported from Russia, the Cape of Good Hope, and South America.

The first process is the separation of the true horn from the bony core on which it is formed: for this purpose the entire horns are macerated in water for a month or six weeks, according to the temperature; during this time the membrane which lies between the core and the horn is destroyed by putrefaction, so that the core becomes loose and is easily extracted. The cores are not thrown away, but are burnt to ashes, and in this state form the best material for those small tests or cupels employed by the assayers of gold and silver.*

The next process is to cut off with a saw the tip of the horn, that is, the whole of its solid part, which is used by the cutlers for knife handles, is turned into buttons, and is applied to sundry other purposes. The remainder of the horn is left entire or is sawn across into lengths, according to the use to which it is destined. Next, it is immersed in boiling water for half an hour, by which it is softened; and, while hot, is held in the flame of a coal or wood fire, taking care to bring the inside as well as the outside of the horn, if from an old animal, in contact with the blaze. It is kept here until it acquires the temperature of melting lead or thereabouts, and, in consequence, becomes very soft. In this state it is slit lengthways by a strong-pointed knife, like a pruning-knife, and, by means of two pairs of pincers applied one to each edge of the slit, the cylinder is opened nearly flat. These flats are now placed on their edges between alternate plates of iron, half an inch thick and eight inches square, previously heated and greased, in a strong horizontal iron trough, and are powerfully compressed by means of wedges driven in at the ends.

The degree of compression is regulated by the use to which the horn is to be afterwards applied: when it is intended for leaves of lanterns, the pressure is to be sufficiently strong (in the language of the workmen) to break the grain: by which is meant separating, in a slight degree, the laminæ of

* They also constitute a valuable durable manure, the fibrils of the roots penetrating the nterstices of the cores, and gradually extracting the rich nourishment which they afford. G.

which it is composed, so as to allow a round-pointed knife to be introduced between them in order to effect a complete separation.

The plates thus obtained are laid one by one on a board covered with bull's hide, are fastened down by a wedge, and are then scraped with a draw-knife having a wire-edge turned by means of a steel rubber; when reduced to a proper thickness and smoothed, they are polished by a woollen rag dipped in charcoal dust, adding a little water from time to time, then are rubbed with rotton-stone, and finished with horn shavings. The longest and thinnest of the films cut off by the draw-knife, when dyed and cut into various figures, are sold under the name of sensitive Chinese leaves (being originally brought from China,) which, after exposure to a damp air, will curl up as if they were alive when laid on a warm hand or before the fire.

For combs, the plates of horn should be pressed as little as possible, otherwise the teeth of the comb will split at the points. They are shaped chiefly by means of rasps and scrapers of various forms, after having been roughed out by a hatchet or saw: the teeth are cut by a double saw fixed in a back, the two blades being set to different depths, so that the first cuts the tooth only half way down, and is followed by the other which cuts to the full depth; the teeth are then finished and pointed by triangular rasps. If a comb or other article is too large to be made out of one plate of horn, two or more may be joined together by the dexterous application of a degree of heat sufficient to melt but not decompose the horn, assisted by a due degree of pressure; and when well managed, the place of juncture cannot be perceived. The Chinese are remarkably skilful in this kind of work, as may be seen in the large globular lantern in the Museum at the East India House, about four feet diameter, composed entirely of small plates of coloured and painted horn. Horn combs are made in London, in York, and in many other English towns; but the chief manufactory of them is at Kenilworth, in Warwickshire.

If a work in horn, such as one of the large combs worn by women, is required to be of a curved or wavy figure, it is finished flat, and is then put into boiling water till it becomes soft, and is immediately transferred to a die of hard wood, in which it is cautiously pressed, and remains there till cold.*

Horn combs ornamented with open work are not made in this country, because the expense of cutting them would be more than the price of the article would repay, but great numbers of them are imported from France. These, however, are not cut, but pressed in steel dies made in London for the French manufacturers; and from an examination of these combs, it is evident that the material must have been in a soft state, approaching to fusion, when put into the die. On referring to French authorities, I find it stated that horn steeped for a week in a liquor, the active ingredient of which is caustic fixed alkali, becomes so soft that it may easily be moulded into any required shape. Horn shavings subjected to the same process become semigelatinous, and may be pressed in a mould into the form of snuff-boxes and other articles. Horn, however, so treated becomes hard and very brittle, probably in consequence of its laminated texture being obliterated by the joint action of the alkali and strong pressure.

Drinking cups of horn are thus made. The horn being sawn to the re-

* Combs among the Romans were made of box-wood.

> Quid faciet nullos hic inventura Capillos
> Multifido *Buxus* quæ tibi dente datur.—MART. *Epig.* xiv. 25.

quired length is scalded and roasted over the fire, as already described; but instead of being slit and opened, is placed while hot in a conical mould of wood; a corresponding plug of wood is then driven hard in, to bring the horn to shape. Here it remains till cold, and is then taken out and fixed by the large end on the mandril of a lathe, where it is turned and polished both inside and outside, and a groove, or chime as the coopers call it, is cut by a gage-tool within the small end for receiving the bottom. The horn is then taken off the lathe and laid before the fire, where it expands and becomes somewhat flexible; a round flat piece of horn, of the proper size (cut out of a plate by means of a kind of crown-saw,) is dropped in, and forced down till it reaches the chime, and becomes perfectly fixed in this situation and water-tight by the subsequent contraction of the horn as it cools. Capt. Bagnold informs me that he has seen in South America a nest of such cups turned to a thickness not exceeding that of a card, and accurately fitting into each other, the outer one holding about a pint and the inner one little more than an ounce.

Horn is easily dyed by boiling it in infusions of various colouring ingredients, as we see in the horn lanterns made in China. In Europe it is chiefly coloured of a rich, red brown, to imitate tortoiseshell, for combs and inlaid work. The usual mode of effecting this is to mix together pearlash, quicklime, and litharge, with a sufficient quantity of water and a little pounded dragon's-blood, and boil them together for half an hour. The compound is then to be applied hot on the parts that are required to be coloured, and is to remain on the surface till the colour has struck: on those parts where a deeper tinge is required, the composition is to be applied a second time. For a blacker brown, omit the dragon's blood. This process is nearly the same as that employed for giving a brown or black colour to white hair; and depends on the combination of the sulphur, which is an essential ingredient in albumen, with the lead dissolved in the alkali, and thus introduced into the substance of the horn.

In very early times bows were made of horn. Homer describes the bow of Pandarus (*Il.* iv.) as made of the two horns of a wild goat united base to base, reduced into proper form and polished, and then tipped with gold. The bow of Ulysses was also of the same material (*Odyss.* xxi.) The long-bow of the English archers was, I believe, entirely of wood; but in the East, even at the present day, bows are made entirely, or in part, of horn. To the kindness of Colonel Taylor I am indebted for the opportunity of exhibiting to you a Chinese bow, made partly of wood and partly of buffalo's horn. The same gentleman likewise informs me, that he has bought in Calcutta pretty good bows, made entirely of buffaloes' horn; but the best Indian bows, those namely of Lahore, are made of horn combined with wood, and strapped round with sinew. Horn lanterns, were also used by the ancients; for we find one mentioned in the *Amphitryo* of Plautus,* and in the epigram of Martial.† Pliny‡ also speaks of horn-lanterns, and says that various other ornamental articles were made of dyed and painted horn.

* Quo ambulas tu, qui Vulcanum in cornu conclusum geris?
Amphitry. Act i. l. 185.

† Dux Laterna viæ clausis feror aurea flammis.
Et tuta est gremio parva lucerna meo.—Mart. *Epig.* xiv. 61.

‡ Cornua apud nos in laminas secta translucent, atque etiam lumen inclusum latius fundunt; multasq. alias ad delicias conferuntur, nunc tincta, nunc sublita, nunc quæ cestrotæ picturæ genere dicuntur.—*Hist. Nat.* xi. 45.

Horn was also used as we now employ glass in windows; for which, however, it is not very well adapted, as plates thin enough to be transparent would soon warp, and be corroded by exposure to the weather.*

Horns are also of very ancient use as musical instruments: the true bugle-horn was made of the horn of the urus, or wild bull, tipped with silver, and slung in a chain of the same material.

Another use to which horn has been applied is as a material for defence. I remember to have seen, several years ago, a complete suit of scale-armour made of horn. It was said to have come from Arabia, and seemed very capable of turning the edge of a sword or pistol-bullet.

I now proceed to mention some particulars respecting TORTOISESHELL.

The animal which produces this beautiful substance is a marine tortoise, called the *Testudo imbricata*, or hawksbill turtle. Its Latin name is derived from the mode in which the scales on its back are placed, overlapping one another like the tiles on the roof of a house. In this circumstance it seems to differ from almost all others of its genus; the scales of other tortoises, both those which are land animals and those which inhabit water, either salt or fresh, generally adhering to each other by their edges, like a piece of inlaid work. These plates, in all the tortoises, cover the bony arch of the back formed by the ribs and spine united into one immovable convexity by flat bones stretching from rib to rib, and uniting insensibly with the spine.

The hawksbill turtle is a native of the torrid zone, and is found in the Indian seas as far as New Zealand, on the Coast of Africa, on that of New Granada, in South America, and in many parts of the West Indies, especially on the Mosquito shore and the promontory of Yucatan. Its usual length is about three feet; but specimens have sometimes been found five feet long, and weighing five or six hundred pounds.

The number of plates produced by each tortoise is thirteen; namely, five along the back, and a row of four others on each side: there are also twenty-five, much smaller ones, forming the margin of the shell. The size and thickness of the plates depend on the magnitude and age of the animal, a fresh layer being produced every year; and at the margin of the large plates may be seen distinctly the edges of the layers as they thin off in succession. Sometimes, however, large plates are met with, so thin as to consist, apparently, of only a single layer. The cause of this anomaly I do not know; but some of the dealers in this article have an opinion that these thin plates are the produce of full-grown tortoises that have been stripped of their plates the year before, either purposely or by accident.

The plates are separated by placing the arch of the shell (all the other parts having been removed) over a fire, which soon causes them to start from the bone, by the help of a slender knife. The price of rough tortoiseshell depends on its quality, that is, on its thickness, and the vividness and distinctness of the colours. The present price for fine shell is about three guineas a pound. Not unfrequently the plates are considerably injured by barnacles, limpets, and other shell-fish, which fix themselves on the animal while alive, and prevent the growth of the tortoiseshell on that part which they occupy. Sometimes one or more of the plates will be of a plain yellow colour; and such are in great request among the Spanish ladies, who will give twelve or fourteen dollars for a comb of plain tortoiseshell, while a similar one of the mottled kind will not sell for more than six dollars. The belly-plates of the tortoise are also yellow, and sometimes clear enough to be made use of.

* Corneum specular.—TERTULL. *de Anima*, liii.

The general mode of manufacturing tortoiseshell is the same as I have already described when treating of horn. It is softened by boiling in water; but mere water takes away much of the colour: an addition of common salt prevents this injury; but if too strong a brine is used the shell will be very brittle. Two or more pieces of tortoiseshell may be joined by laying their scraped or thinned edges together, and then pressing them between hot iron. If, however, the heat is too great, the colours are much deepened so as to become almost black, as is the case with moulded snuff-boxes; for tortoiseshell being less fusible than horn, cannot be made soft enough to be moulded without some injury to the colour. Accordingly the manufacturers, at least in England, never attempt to produce tortoiseshell combs with ornamental open work by means of dies, but in the following manner:

A paper being pasted over the tortoiseshell, the pattern is drawn on the paper, and is then cut out by means of drills and fine saws: the paper is then removed by steeping in water, and the surface of the pattern is finished by the graver.

In making small side-combs, it is found worth while, in order to save a costly material, to employ a machine consisting of a cutter working straight up and down, and of a bed (on which the shell is laid,) to which is given a motion advancing by alternate inclination, first to one side and then to the other. By this means the teeth of two combs are cut at the same time, those of the one occupying the intervals of the other. Such combs are called *parted*, the saw not being used upon them; and are often made of fine stained horn instead of tortoiseshell. Tortoiseshell is also used for inlaying tables, cabinets, and other ornamental articles, a metallic foil being placed below it to give lustre and colour. This employment of it appears to be coming at present considerably into fashion.

Among the Romans of the Augustan age, this taste was not so much a fashion as a fury. The frames of the couches on which they reclined at table were covered with the largest and most beautiful plates that could be procured of tortoiseshell;* and it was employed for various other similar purposes: but I am not aware that it was ever used by them as a material for combs. It was brought by Indian and Arabian traders from the islands in the Indian Sea to Adulis,† in Abyssinia, together with ivory, rhinoceroses' horns, and hippopotamuses' hides. Here it was purchased by Egyptian merchants, was transmitted to Alexandria, and thence passed to Rome and the other great cities of the empire. For modern uses, thick tortoiseshell is more valuable in proportion than thin; but among the Romans, where it was used only for inlaying, veneers were cut out of it. This art was the invention of one Corvilius Pollio, a man, as Pliny‡ says, of singular sagacity in all things that ministered to a prodigal luxury.

* Attonitus pro
Electro signisq. suis Phrygiâ columnâ
Atq. Ebore, et latâ Testudine.—Juven. xiv. 306.
Ut testudineo tibi, Lentule; conopeo
Nobilis Euryalum myrmillonem exprimat infans.—*Ibid.* vi. 80.
Gemmantes primâ fulgent Testudine lecti.—Mart. xii. 66.
Et Testudineum mensus quater hexaclinon.—*Ibid.* ix. 60.
Varios—pulchrâ Testudine postes.—*Georg.* ii. 463.

† Opidum Aduliton—maximum hic emporium Trogloditarum, etiam Æthioprum,—Defe runt plurimum Ebur, Rhinocerotum cornua, Hippopotamorum coria, chelyon Testudinum. —Plin. *Hist. Nat.* vi. 34.

* Testudinum putamina secare in laminas, lectosque et repositoria his vestire, Corvilius Pollio instituit, prodigi et sagacis ad luxuriæ instrumenta ingenii.—Plin. *Hist. Nat.* ix. 13.

WHALEBONE, as I nave already stated, may be considered as a kind of horn; which latter substance it resembles perfectly, both in its chemical and principal physical properties, and is particularly interesting as forming the transition from horn to hair.

It is the substitute for teeth in the Greenland whale, and in the black southern whale, but is not found in any of the cetaceous animals that have teeth.

The food of the Greenland whale is a small crustaceous animal, not so large as a common shrimp; and the whalebone forms the apparatus by which this huge animal secures the minute prey that he lives on. From the roof of the mouth hang down on each side of the tongue about three hundred blades of whalebone, all the blades on one side being parallel to each other, and at right angles to the jaw-bone. On account of the arched form of the roof of the mouth, the blades about the middle of the series are the longest, and they diminish gradually towards each end. The average length of the middle blades is about nine feet; but they have occurred of the length of fourteen or fifteen feet. These blades hang down in the mouth so that the hairy side shall be the innermost; the hairs forming a net or filter through which the water escapes, leaving the shrimps behind.

The surface of the blade is compact, and susceptible of a high polish by mere friction. Its texture is lamellar in the direction of its breadth, so that it easily splits and divides in this direction, but not in that of the thickness of the blade: the middle of the blade is of a looser texture than the rest, and is technically called the grain, being composed of coarse, bristly hairs. The general colour of whalebone is a dusky greyish black, intermixed with thin strips, or layers of a paler colour, which are often almost white—very rarely the entire flake is milk-white.

The preparation of the whalebone for use is very simple. It is boiled in water for several hours, by which it becomes soft enough to be cut up, while hot, in lengths of different dimensions, according to the use to which it is to be applied; or, by means of a compound guarded knife, is cut into fibres for brushes, which are at present extensively used in stables for the first process in cleaning a horse. Whalebone that has been boiled, and has become cold again, is harder and of a deeper colour than at first; but the jet-black whalebone has been dyed. The principal consumption of whalebone at present is for stretchers to umbrellas and parasols: it is also used, though not so much as formerly, in giving stiffness to women's stays. Whips are also made of platted whalebone, both black and white: the latter are very beautiful. White whalebone has also been made into ladies' bonnets, and likewise into artificial flowers, as its texture is well adapted to this purpose; and it will, by the usual dying processes, take very bright and durable colours.

Trans. Soc. Arts.

On moistening the Air in Hot-houses. By T. APPLEBY, *Gardener*.

The successful cultivation of orchidaceous plants being now almost an essential qualification for every gardener, I am induced to add my mite to the many useful directions that have appeared in your interesting miscellany. It is in consequence of having adopted something new (at least to me) in the method of moistening the air in our orchidaceous houses, that I am induced to send you the following account of our success.

We have two houses devoted to the culture of this interesting and fashionable family of plants. They are heated by hot water, one with round

pipes, the other with square ones; and, although we had pools inside, and frequently wet the floors and the pipes, yet we still found the air much too dry. To overcome this many were our projects, and in the end it was resolved to put up a small steam boiler with a main pipe to convey the steam inside, and branch pipes to different parts, in order to fill the houses completely and equally at once with steam. This, after some little failures, and various trials, we have at length happily accomplished. The effect had far surpassed my most sanguine expectations. In twenty minutes after lighting the fire, the houses are so filled with steam that I cannot see the plants, when I am in the houses, at two yards' distance; whilst the plants themselves are covered with the finest dew imaginable, and though they have been immersed in this vapor twice a day, an hour each time, for now nearly two months, they are not in the least injured, but on the contrary highly benefited. Plants that had been at a stand here for eighteen months are now beginning to grow, while others that were sickly are now fast recovering. The most delicate flowers are not injured, nor their duration shortened; whilst many species, considered difficult to flower, are now showing buds. The benefit to those plants which are hung up in baskets, or fixed to blocks of wood, is very apparent.

I may also mention that we grow a few of the choicer stove plants amongst the Orchideæ, and their appearance shows that they derive benefit from the vapor with which they are surrounded. Some of these were infested with the red spider, but this warm vapor bath was fatal to the insects, as indeed was naturally to be expected.

Having thus related to you our success, I shall now endeavor briefly to describe the apparatus by which it is effected.

The boiler is placed in the back shed, and is made of copper, and weighs 80 lbs. with the taps included. It is furnished with a safety valve, a tap and funnel at the top to pour in the water, a tap at the bottom to let out the water, another to show when there is water in sufficient to allow room for steam to be generated, and a tap at the top with a small pipe attached which nearly reaches down to the bottom of the boiler. This last is to show when the water is too low, which it does by permitting steam to escape, which would not be the case so long as the end of the attached small pipe was covered with water.

The pipe that conveys the steam into the houses is $1\frac{1}{2}$ in. in diameter; it rises from the boiler 3 ft., and is then carried through the back wall down to the floor inside, under the back stage; it then branches right and left to each end of the houses; is then led across each end, and on the front; the branches on the ends and in the front being reduced to 1-inch pipe. In those pipes, and also on the back, are holes drilled every six ft., into which holes small pipes 6 in. long are screwed. These small short pipes are in the form of the letter T, to throw the steam horizontally, so as to diffuse it through the air before it reaches the pots or plants.

We soon found the small pipes on the main back one were not necessary, as the steam spread itself from the front and ends quite sufficiently for our purpose. The cost of fuel for this apparatus is but trifling, and the steam and the pipe that contain it heat the houses so much, that a very considerable saving of coals in the hot-water boilers is the consequence. We have therefore attained two objects; the supplying of moisture to the internal atmosphere most effectually, and a saving of fuel.

The boiler and pipes and fitting up cost about 13*l.*; but, if we had had an iron boiler instead of copper, it would not have cost more than 10*l.*

The question now is, whether the above method is worthy of imitation. All I can say on the matter is, that both Mr. Brocklehurst (my spirited employer) and myself are perfectly satisfied with it, and I shall be happy to give any further information to you or any of your readers who may require it.

Gardener's Mag.

Extraordinary Manner of Manufacturing Cloth.

A gentleman, residing at present in London, has just obtained, we are told, a patent for making the finest cloth for gentlemen's coats, &c., without spinning, weaving, or indeed without the aid of any machinery similar to those processes, and at a cost less than one-fourth the present price. The most extraordinary circumstance in this contrivance is, that air is the only power used in the manufacture of the article. The ingenious inventor places in an air-tight chamber a quantity of flocculent particles of wool, which by means of a species of winnowing-wheel are kept floating equally throughout the atmosphere contained therein; on one side of the chamber is a net-work of metal of the finest manufacture, which communicates with a chamber from which the air can be abstracted by means of an exhausting syringe, commonly called an air-pump, and on the communication between the chambers being opened the air rushes with extreme vehemence to supply the partial vacuum in the exhausted chamber, carrying the woolly floccula against the netting, and so interlacing the fibres, that a cloth of a beautiful fabric and close texture is instantaneously made. Several of the specimens of this cloth that have been shown to scientific gentlemen and manufacturers have excited great admiration. This cloth is a species of felt, but instead of adopting the old laborious method, the above, which is denominated the pneumatic process, is used, and produces the result as it were by magic.

Arch. & Civ. Eng. Journ.

Kalsomine.

A new and inodorous sort of paint, the invention of Miss Fanny Corbaux has been lately introduced to public notice. The materials of which it is composed are at first soluble in water; and while in this state admit of the design being effaced, or a portion of the coloring of a wall or ceiling being removed, if necessary; a subsequent operation renders the paint insoluble, by a chemical change of the properties of the material, which fixes the colour durably. It is free from any offensive smell, dries in a few hours, is not acted upon injuriously by atmospheric influences, and is said to be more durable than oil paint, as well as more agreeable to the eye, and not at all prejudicial to the health; indeed a room painted with it one day, may be inhabited the next. It may also be made applicable to easel painting also. We have seen a little landscape painted with this material, which combined something of the depth and solidity of oil with the transparency of water-colour; and a specimen of broad flower painting, for a room, was shown us, which possessed remarkable purity of tone, and a brilliancy of effect superior to any ornamental painting we have seen; and which had resisted the rude action of the scrubbing-brush. The effect of the white, as a ground for gilding, is extremely clear without being dazzling; and we can well understand that it possesses the property ascribed to it of "softening and diffusing light."

Athenæum.

Progress of Physical Science.

Experiments and Observations on Light which has permeated coloured Media, and on the Chemical Action of the Solar Spectrum. *By* ROBERT HUNT.

M. Gay Lussac, when speaking of the beautiful discovery of M. Daguerre, said, "the palette of the painter is not very rich in colour; black and white compose the whole. The image, in its natural and varied colours, may remain long, perhaps forever, a thing hidden from human sagacity."*

However, the production of a coloured picture of the spectrum by Sir John Herschel, and some effects produced by Mr. Talbot, together with some delicate tinting which I observed, when, during the summer of 1839, I was engaged in copying some flowers of Nature's richest painting, led me to think coloured photographs within the range of probabilities, and induced me to pursue a train of experiments, from which, although little has resulted to heighten my first hopes, I have gathered much that is curious and certainly instructive.

Photographic Papers.

1. By saturating paper with different chlorides and muriates, always keeping in view the definite proportion required for the quantity of nitrate of silver used; it will be found that almost every variety of shade, from a rich dark purple to a full red, and a few other tints, may be produced at pleasure.

2. The effects of light, passing through coloured glasses on various papers, are singularly diversified. The following are a few of the most striking results. (The glasses are, a deep cobalt blue, a full laurel green, an amber yellow, and a rich orange red. They are so framed that all the papers can be exposed at the same time to the solar influence.)

Colour of Glass.

	Blue.	*Green.*	*Yellow.*	*Red.*
Salt used.	Effects produced.			
a. Chlor. of sodium.	Purple.	Blue.	Violet,	Chocolate.
b. Chlor. of potassa.	Light purple.	Sky blue.	Light violet.	Tinted red.
c. Muriate of lime.	Rich violet.	Faint blue.	Blue.	Reddish.
d. Muriate of iron.	Red.	Colourless.	Faint red.	Leaden hue.
e. Muriate of peroxide of iron.	Blue.	Yellowish.	Straw colour.	Yel. brown.
f. Mur. of baryta	Purple red.	Lilac.	Chocolate.	Pink.
g. Muriate of manganese. . .	Rich brown.	Reddish.	Rose hue.	Yellow.
h. Mur. of ammonia.	Olive brown.	Pale brown.	Brown.	Dull orange.

3. I have found but a modified action from the interference of coloured fluids. In a few instances, under a solution of carmine in ammonia, I have obtained the richest crimson dye; but I cannot, by any means I have used, succeed in fixing the colour on the paper.

* The History and Practice of Photogenic Drawing, &c., by L. J. M. Daguerre. Translated by J. S. Memes, LL. D."

4. A paper prepared, by first washing it with a solution of twelve grains of iodide of potassium in one ounce of water, and then with a solution of ten grains of the crystalized nitrate of silver in the same quantity of fluid, is very sensitive. When exposed beneath a solution of the ammonia-sulphate of copper to sunshine, it changes to a rich *light blue*. Acetate of copper produces a *brown*. Muriate of the peroxide of iron imparts a *green tinge*, and solutions of carmine a *brown red*.

5. The paper, *f*, becomes *red*, when acted on by rays passing through nitrous acid gas, and is tinged *yellow*, by the light which has been subjected to the interference of chlorine and its protoxide.

6. To have as full a volume as possible of iodine and bromine vapour, carefully closed vessels, containing a small portion of these bodies, were placed upon a plate of copper warmed by water.

The paper, *h*, was laid beneath them, and exposed to luminous influence. Under the bromine it was unchanged, but beneath the iodine the paper became richly iridescent. The colours changed to a uniform violet tint upon a few minutes exposure to direct sunshine.

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7. Papers already darkened by sunlight during prolonged exposure to the influence of the dissevered rays of the spectrum, assume a variety of colours. The same changes may be effected by carefully arranging glasses, and placing the photographic preparations beneath them. I shall copy exactly the memoranda of my journal.

Dec. 12, 1839.—I placed under blue, green, yellow, and red glass, the following papers:

A. *Muriate of ammonia*, with two washings of solution of the nitrate of silver, darkened by exposure to a rich chocolate.

B. *Muriate of manganese*. Silver, two washings, darkened to a full brown.

C. *Iodide of potassium*. Silver, one washing, darkened to a yellow brown.

D. *Iodide of potassium* and silver, two washings, darkened to a red brown.

E. *Chloriodic acid*. Silver, two washings, darkened to a rich bronze.

F. *Chloriodic acid* with *Liquor potassæ*. Silver, two washings, darkened to a blue brown.

Dec. 13.—After twelve hours exposure to the dull light of rainy weather, the paper, E, has become blue under the blue glass. No change is apparent on the others.

Dec. 27. *Colours of Glass.*

	Blue.	*Green.*	*Yellow.*	*Red.*
A. has become	Olive.	Deep green.	Dirty yellow.	Red.
B. do.	Deep brown.	Bat colour.	Blue brown.	Red.
C. do.	do.	Darkened.	No change.	Red brown.
D. do.	Black.	Light brown.	Rich brown.	Brick red.
E. do.	Blue black.	Darkened.	Darkened.	Dusky red.
F. do.	Black brown.	Dull plum.	Bluish.	Reddened.

Jan. 2, 1840.—All the papers go on increasing the distinctness of their colours, except E and F, which have assumed different shades of blackness.

(E *and* F *were removed, and a paper*, G, *prepared with muriate of baryta and two washings of silver, darkened to a chocolate, substituted.*)

Feb. 7. *Colours of Glass.*

	Blue.	*Green.*	*Yellow.*	*Red.*
A. has become	Rich olive.	Green.	Yellow.	Purple.
B. do.	Black.	Chocolate.	Light brown.	Red.
C. do.	Do.	Red brown.	Do.	Brown.
D. do.	Chocolate.	Umber brown.	Black.	Red brown.
G. do.	Bright olive.	Yellow brown.	Pale olive.	Reddish.

The two papers, A and G, exhibit much more sensitiveness to luminous influence than any others I have yet tried.

8. The paper, A, when washed with a weak solution of the hydriodate of baryta, gives under the pencil of light a beautiful picture, whether used in the camera or for surface drawings.

These pictures exhibit the peculiarities mentioned by Mr. Talbot at the British Association.* Sunshine changes "the colour of the object delineated from reddish to black with great rapidity." This gentleman adds, "after which no further change occurs." I much regret I have not been fortunate enough to succeed thus far in fixing my drawings. The continued influence of light in a few months obliterates the impression.

A singular change follows the exposure of these pictures to coloured light.

If placed under vessels containing coloured fluids, (4) and exposed either o sunshine or diffused light, in a few days the picture becomes a full *red* under the blue; a *rose hue* under the green; a *light blue* under the yellow, and a *deep blue* under the red. These colours, after deepening for some time, gradually change to different shades of green under the blue and green fluids, to a pink under the yellow, and a red under the red fluid (25.) After this, the colours alter no more, and the picture bears exposure to light much better than at first; but I doubt if it is rendered permanent, for the dull light of January and February has spread a downiness, like a mist, over those photographs which have been constantly exposed.

Daguerreotypes.

9. Exposing a plate, over which some lace was carefully placed, under four coloured glasses (2.) for three minutes to diffused light, I obtained, under the blue glass, a beautiful copy; no trace of a drawing beneath the green; a tolerable impression beneath the yellow; but the mercury would not attack the space beneath the red.

10. A plate similarly arranged beneath four bottles of coloured fluid (4.) exposed to diffused light for fifteen minutes, was found, on being acted upon by the mercurial vapour, to present the same appearance as above, (9.) excepting that a faint design was evident over the space the carmine fluid had covered.

11. I arranged a dark chamber, to which no other rays could pass but such as had permeated *two inches* of coloured fluid.

Having filled my trough with a saturated solution of the bichromate of potassa, I exposed a plate for five minutes to its influence in full sunshine. *There was not the slightest action.*

12. In one hour, on a similar plate, under the same circumstances, I obtained a faint but still defined outline of a dried fern.

13. I exposed a bare iodidated plate for two hours to the same influence.

* Athenæum, No. 618.

On removing it from the chamber, no difference was apparent; but I found it was no longer sensitive to light, and the iodide adhered more closely to the metal than it did (28.)

This is a reverse action, for after the exposure of a prepared Daguerreotype plate to light, the sensitive film is most easily rubbed off* (28.)

14. Red solutions impart a very decided rose hue, or more strictly speaking, the influence of red light on the iodidated plate occasions that peculiar arrangement of the mercurial particles, which is necessary to the production of red colour.

15. Green solutions act with more or less effect in obstructing the passage of the so-called chemical rays, according to their depth of colour. But in no instance have I found them to produce that close combination which the yellow and sometimes the red fluids do, of the iodide and the under surface of unattacked silver (28.) By examining the effects produced by green media (2, 7, 16.) a peculiar order of interference will be remarked (19.)

Germination and the Growth of Plants.

16. I planted in a box some curled cress seed, and so arranged bottles of carmine fluid, chromate of potassa, acetate of copper, and the ammonia sulphate, that all but a small space of the earth was exposed to light which had permeated three-fourths of an inch of these media.

For some days, the only apparent difference was that the earth continued damp under the green and blue fluids, whereas it rapidly dried under the red and yellow. The plumula burst the cuticle in the blue and green lights, before any change was evident in the other parts.

After ten days, under the blue fluid there was a crop of cress, of as bright a green as any which grew in full light, and *far more abundant.*

The crop was scanty under the green fluid, and of a pale unhealthy colour (15.)

Under the yellow solution but two or three plants appeared, yet they were less pale than those which had grown in green light. Beneath the red bottle the number of plants which grew was also small, although rather more than in the spot the yellow covered. They too were of an unhealthy colour.

17. I now reversed the order of the bottles, fixing the red in the place of the blue, and the yellow in that of the green. After a few days exposure, the healthy cress appeared blighted, while a few more unhealthy plants began to show themselves from the influence of the blue rays, in the spot originally subjected to the red.

It is evident from this, that the red and yellow rays not merely retard germination, but positively destroy the vital principle in the seed. Prolonged exposure uncovered, with genial warmth, free air, and indeed all that can induce growth, fails to revive the blighted vegetation.

I have repeated the experiments many times, varying the fluids, but the results have been the same. At this time I have the above facts strikingly

* On this principle I now polish my silvered plates, by which the troublesome process with nitric acid and pumice is got rid of. I wash the surface of silver over with a solution of the iodide of potassium holding a little iodine free, and rub it lightly until all the parts are equally attacked. I then expose the plate to light for a few minutes, and polish off with dry cotton. In five minutes, by this process, the most perfect lustre may be given to the silver, and it has the advantage of rendering the plate more susceptible to the influence of the iodine vapour.

exemplified where the space covered by the bichromate of potassa is without a plant.

These results merit the attention of those who are engaged in the study of vegetable economy. Do not they point at a process by which the productions of climes more redolent of light than ours may be brought in this island to their native perfection?

Dr. Draper's "experiments" (Philosophical Magazine, Feb. 1840, pres. vol. p. 81) appear at variance with mine.

Under the influence of a nearly tropical sun permeating half an inch of solution of the bichromate of potassa, cress grew of a green colour, whilst it took five days to give a sensitive paper a faint yellow green colour. From this Professor Draper argues the existence of two classes of rays, a different class being necessary to produce the green colouring of vegetable foliage from that which darkens chloride of silver.

With submission to one whose facilities for such inquiries are so much greater than my own, I would suggest a repetition of the experiments with some of the recently discovered photographic preparations. The papers, *f*, and *h*, both under coloured glass and great thicknesses of yellow fluid, are deepened to a plum-brown in less than an hour.*

Under three inches of the bichromate of potassa, the paper, *f*, became, in eight hours sunshine, of a full blue-brown.

18. The fact of cress and peaplants growing green, under the influence of such powerful light as penetrated Professor Draper's yellow media, will not appear at all surprising when we examine the rays which pass through such fluids.

This I have done by forming a spectrum, interposing the coloured body between the prism and the sun. The following are the effects of February sun at Devonport.

Through a deep blue solution of the ammonia-sulphate of copper, the violet, indigo, blue, and a portion of the green rays pass.

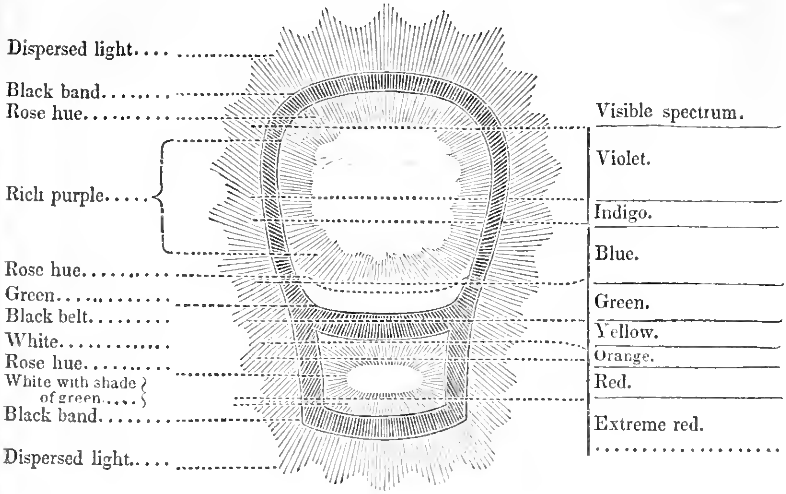
Through solutions of the muriate, acetate, and nitro-muriate of copper with iron, the green ray, and a considerable portion of the yellow; a trace of the blue also is evident.

Through solutions of the bichromate and chromate of potassa, the chloride of gold and decoction of turmeric, the red, the yellow, and the green rays are seen, *and by taking their impression on a Daguerreotype plate, a line of the blue is distinctly marked.*

Through nitro-muriate of cobalt in ammonia, carmine in ammonia, and sulphuric acid and decoction of cochineal, the red and yellow rays alone appear to penetrate.

* The papers which accompany this article were exposed under the glasses and three-fourths of an inch of fluids for forty minutes. The order of interference and consequent colouring is plainly shown.

The Spectrum.



19. It will be observed, that the light which has passed through a green medium (2, 7, 9, 10, 15, 16.) acts less powerfully in darkening photographic papers, and occasions vegetable leaves to be even paler than that which has been subjected to the interference of a yellow medium.

I am led to suspect that the band of rays formed by the meeting of the yellow and the green has an influence similar to the extreme red, in neutralizing the powers of the other adjacent rays, as was first noticed by Sir John Herschel, (22.,) (23.,) (26.)

20. The annexed figure represents the solar spectrum, as it impresses itself on a Daguerreotype plate, not in shadows merely, but in colours, which have the peculiar appearance of the down upon the nectarine.

The most refrangible portion of the spectrum is represented in full colours, shading from indigo to a delicate rose, which is lost in a band of pure white.

21. Beyond this a protecting influence is powerfully exerted, and notwithstanding the chemical effect produced over the plate, by the dispersed light, a line is formed free of mercurial vapour, and which consequently appears black.

22. The green portion of the spectrum is represented in its true colour, but it is considerably less in size than the space occupied by these rays.

23. The yellow rays are without action, or rather they do not prepare the silver for the reception of the mercury, and consequently a black belt marks the space on which they fell, and extends a little beyond it into the green (19.)

24. A white line marks the place of the orange light.

25. The red is represented by a well defined rose colour, bounded, as

were the more refrangible rays, by a white line, shaded, at the lower extremity, with a green.

This passing of the red into a green, and of the blue into a rose colour, (20.) is strikingly similar to the effect produced, by the interference of coloured media, on some photographic drawings (8.)

26. The lowest dark space on the picture is a beautiful illustration of the influence of the extreme red rays in protecting the silver from luminous action (19.) (21.)

27. What appears more surprising to me than even the detection of the *negative?* rays at each end of the prismatic spectrum, is the continuation of the dark line throughout *its whole length*, evidently showing the influence of the same cause as is so effective at the least refrangible extremity.

This band is not equally defined throughout its entire circumference. It is the most strikingly evident from the extreme red to the green; it fades in passing through the blue, and increases in intensity as it leaves the indigo, until, beyond the invisible chemical rays, it is nearly as strong as it is at the calorific end of the spectrum.

Does not this protected surrounding band appear to indicate the existence of rays of a peculiar and unknown order, proceeding from the extreme edge of the sun?

28. By lightly rubbing a Daguerreotype picture of the prismatic rays, it is obliterated, except over the space of the yellow and red portion. This effect corresponds with my experiments on media of these colours (11. 12. 13.)

Until we have more experience than we now have of the effects of the solar rays individually and collectively, we can offer no satisfactory explanation of the process in action, on a Daguerreotype plate, by which the subtle painter, LIGHT, impresses such delicate designs.

The existence of two iodides of silver, is, I think, certain. In my photometric experiments, I have always observed the formation of an iodide which speedily darkens, and of another portion which is unalterable by light.*

The sensitive film on the silver plate appears to be the former of these iodides. Throughout the range of the chemical spectrum, *particularly so called*, the iodide is I imagine converted into an oxide of silver; that a partial oxidation takes place, numerous experiments have rendered certain; whilst the influence of the rays of least refrangibility is to form the unchangeable iodide of silver. Experiments, however, are wanting to prove this satisfactorily.

An attentive consideration of the facts I have enumerated, will, I think, satisfy all, that we can no longer with propriety attach the name of chemical to the most refrangible rays only. Every ray has its particular chemical office, either of composition or of decomposition; and although Seebeck has attributed the acquirement of a rose hue by chloride of silver when put into the red ray, to the heating power of that portion of the spectrum, it is now proved to be dependent upon some other influence, for where it has been shown the most calorific rays exist, this salt undergoes no change.

Devonport, February 29, 1840. Lond. & Ed Philos. Mag.

* See Mr. Talbot's account of the processes employed in Photogenic Drawing Lond. and Edinb. Phil. Mag., vol. xiv., p. 210 (2.)—EDIT.

Deep Soundings.

The following extract of a letter from Capt. James Ross, R. N., to the hydrographer of the Admiralty, will interest our readers. It will be seen that the mean velocity of the weight in descending 2677 fathoms was 3.2 per hour; the first 50 descended at the rate of 7.1 miles, and the last 100 at 2.4 miles per hour. This is one thousand fathoms less than the soundings in the last number.

H. M. S. Erebus, at sea, 3d March, 1840.

(Lat. 33° 21′ S. long. 9° 4′ E.)

"I have just obtained another deep sounding, and although we have not yet been able to get down so far as I wished, and still hope to do, I am quite satisfied that if we get into any sea deep enough, we shall have no difficulty in accomplishing it. The weight employed was 540 lbs., and we had on the reel something more than 5000 fathoms of line: the first 437 fathoms were a single strand of whale line; the rest was of two strands of three-yarn spunyarn, and the following are times of each of the marks passing off the reel.

	h.	m.	s.	Intervals. m.	s.
Let go at	10	33	58		
50 fathoms		34	23	0	25
100		34	53	0	30
150		35	22	0	29
200		35	54	0	32
250		36	26	0	32
300		37	3	0	37
350		37	40	0	37
400		38	20	0	40
477		39	32		
next 100		40	59		
200		42	31	1	32
300		44	8	1	37
400		45	48	1	40
500		47	28	1	40
600		49	14	1	46
700		51	2	1	48
800		52	58	1	56
900		54	56	1	58
1000		56	56	2	0
100		58	56	2	0
200	11	0	56	2	0
300		2	55	1	59
400		5	2	2	7
500		7	14	2	12
600		9	27	2	13
700		11	42	2	15
800		13	58	2	16
900		16	19	2	21
2000		18	44	2	25
100		21	11	2	27
200		23	37	2	26
——		——	—— stopped exactly at the mark.		
Total 2677 fathoms= 3 miles 74 yards.		29	39 time of sounding		

Crozier took down the time of each mark passing off the reel, and when the weight struck the bottom, it stopped so suddenly that the boats' crew all called out, "It is down." We veered away 50 fathoms afterwards, and then hauled in again, but could not get an inch more than the mark at which it first struck. Nothing could be more satisfactory than this sounding, and it is the more so from shewing very plainly that we have the means of getting soundings however deep the sea may be, and I trust our next trial will be in deeper water. I have ordered the line to be again completed to 5000 fathoms; but it would be useless to attempt it any more on this side of the Cape. JAMES F. ROSS.

Naut. Mag.

On Certain Effects of Temperature. By C. T. COATHUPE, *Esq.*

Having, from the nature of my occupations, an excellent laboratory for observing the effects of temperature, I beg to offer you some experiments illustrative of some of these effects.

A modern glass-house is generally a cone built of brick, having its interior diameter, at the base, varying from 58 to 60 feet, and its perpendicular height varying from 90 to 100 feet. The upper aperture through which the smoke ascends, varies from 9 feet 6 inches to 10 feet in diameter. This cone terminates at its base in substantial pillars of brick about 3 feet square, following the exterior inclination of the surface of the cone, and united above by arches which spring from pillar to pillar, and below by inverted arches beneath the ground.

Around the centre of the interior floor of this cone, the furnace is erected; and around the exterior of the pillars which support the main body of the cone, the glass-house is extended by shed roofs, whose rafters bear against the exterior of the brick cone, above the arches which connect the pillars. This extension constitutes the manufacturing workshop, or space occupied by the glass-making operatives. The interior space around the furnace and within the pillars, is that occupied by the founders, or the men whose duty it is to fill the pots with raw materials for the production of glass, to urge the fire, to examine from time to time the state of fusion, and in short, to make from sand, alkali and lime, by the aid of intense heat, the material which the glass-making operatives subsequently convert by manipulation into glass.

For very many consecutive hours during the process of founding the raw materials, a thermometer placed at the greatest possible distance from the furnace, but within the area occupied by the founders, and freely suspended from a rod projecting from the interior surface of one of the brick pillars (a distance in the present instance = to 20 feet 5 inches,) will indicate a temperature varying from 316° to 325° of Fahrenheit. The founders have cool recesses, into which they frequently retire during their work, but the average of temperature here mentioned, viz: from 316° to 325°, and frequently very much beyond 325°, they bear without experiencing any inconvenience whatsoever. Strangers universally wonder at the possibility of human beings existing in a situation in which their clothes are continually scorched, while their naked skin exhibits no marks of the effects of fire. I had myself often wondered at the circumstance, until I made some experiments to endeavour to ascertain the cause of such an anomaly. The results of some of these experiments are curious from the extent of the ranges of

the temperatures, and I have much pleasure in proffering them to those of my philosophical brethren who may feel an interest in such matters.

Exp. 1. Two silver brass scale thermometers, having each a range of 600° Fahrenheit, were suspended from an iron pin at a distance of two inches from the interior surface of one of the brick pillars of the glass-house, at a distance of 20 feet 5 inches from the nearest point of the furnace emitting flame, and during the early part of the founding process.

They both indicated, from an average of ten simultaneous pairs of consecutive observations which ranged well together, a temperature of 194°.4 Fahrenheit.

Exp. 2. One of the thermometer bulbs was now clothed with a thin case of fine black "merino." The average of ten simultaneous pairs of consecutive observations indicated a difference of temperature manifested by the clothed bulb, in excess of that manifested by the unclothed bulb, of 23°.1 Fahrenheit upon each pair of observations. Hence 23°.1 of Fahrenheit were retained by the covered bulb, which were evidently reflected, and lost to observation, by the bright metallic surface of the unclothed bulb.

In another series of experiments, wherein the temperature indicated by the unclothed thermometers averaged only 124°.5 Fahrenheit, from twelve pairs of observations, the increment shown by covering one of the bulbs with a thin bag of black "merino," amounted to 34°.66 Fahrenheit. Hence the quantity of heat that is reflected from the bright surface of a thermometer diminishes as the heat itself increases.

Exp. 3. During the latter part of the founding process and whilst the clothed thermometer suspended from the brick pillar ranged from 320° to 325° Fahrenheit, a small black iron cylindrical pan, filled with water, was placed upon a thin iron shelf, which had been fixed against the pillar and close by the side of the thermometer. It was reasonably anticipated that water thus placed in a temperature of 320° to 325° would boil; but after waiting until the half of it had evaporated, it showed no tendency to ebullition.

Exp. 4. The top of the iron pan was now covered with a pane of window-glass, and in a few minutes it boiled violently. This experiment demonstrated that the cooling properties of rapid evaporation can neutralize one of the direct effects of heat to a very surprising extent, and to ascertain the amount of this influence the following experiment was instituted.

Exp. 5. A clothed thermometer, whilst the mercury was indicating a temperature of 310° Fahrenheit, was immersed in a vessel of boiling water. the mercury *instantly* fell to 212°, and then *very gradually* sunk to 141°. The merino envelope had become dry, and the mercury had commenced rising when the bulb was immersed a second time into the water. The mercury rose to 202°, and then gradually fell to 139°. By a third immersion the mercury rose to 198°, whence it fell *gradatim* to 133°. The envelope was now saturated with water at about 140° Fahrenheit, but the mercury speedily reassumed the temperature of 133° Fahrenheit, and remained at this fixed point for nearly five minutes, although the real temperature of its situation was, and had been for many previous hours, 310° Fahrenheit.

The effects of rapid aqueous evaporation were thus clearly shown to influence the indications of the thermometer when placed in a dry atmosphere of 310° Fahrenheit, and under the circumstances described, to the surprising extent of 177° Fahrenheit.

We may now infer that the *copious perspiration* which exudes from the skin of glass-makers, and of those who are engaged in similar scorching

occupations, is a sufficient protection from the burning effects of a *dry* atmosphere of from 300 to 400 *degrees of Fahrenheit;* and that whilst the clothes of such persons are burning to tinder, their skin may be rendered insensible to the direct effects of the fire upon the inanimate matter around them, by simple natural laws, viz: those of evaporation.

Having been engaged in some delicate experiments on the subject of heat, I was surprised at the effects of comparatively moderate *dry* temperatures upon such thermometer scales as were made of ivory.

In one instance the scale became shortened two degrees in 100 in a temperature of 212° Fahrenheit.

In another, an old and "well-seasoned" ivory scale, that had often endured the maximum solar heat of Jamaica and the salt waters of the Atlantic, became shortened one degree in 110° from a *dry* temperature of 130° Fahrenheit.

In a third, the scale became shortened $1\frac{1}{2}$° in 120° from a short exposure to a *dry* heat of 260 Fahrenheit. Immersion in water will generally restore such scales to their original length. Lond. and Edin. Philos. Mag.

Progress of Civil Engineering.

Resistance of Air to Railway Trains. By Dr. Lardner.

At the Liverpool meeting of the Association, in the autumn of 1837, an inquiry was undertaken by Dr. Lardner, in connexion with some other members of the Association, with a view to determine the mean numerical value of what were called *Railway Constants* by analogy to similar numerical quantities in other branches of science and art. *Constants* is a technical name given to certain quantities, more especially in astronomical and physical science, which enter largely into general calculation. As an example of these, may be mentioned, the height through which a body falls in a second of time; the length of a second's pendulum; the ratio of the circumference of a circle to its diameter, and so on. A project of a magnificent kind was formerly suggested by Mr. Babbage, for the determination of the mean numerical values of the "Constants of Nature and Art." Among these quantities which enter railway calculations, that which is of the greatest practical importance, is the number by which is expressed the proportion which the tractive power, necessary to move loads on a railway, bears to the weight of the loads it moves. The great importance of this will be really perceived, if it be considered that such is in fact in a great degree the ratio of the cost to the work done. Accordingly, the first point to which this inquiry was directed was, the solution of that problem.

The resistance opposed by a railway train, to the power which draws it, arises from several causes: 1st, the friction or attrition of the axles of the wheels in their bearings; 2d, the rolling friction of the tires of the wheels upon the rails; 3d, the resistance of the air to the train moving through it. These are all the causes which produce resistance in the train moved. But independently of these, there are resistances peculiar to the engine, arising from the friction or attrition of the various parts of the machinery which are in motion, and which suffer a pressure or strain, depending on the resistance of the load drawn; also, the re-action of the steam, escaping from the

blast pipe on the other side of the piston, and other similar causes. But to simplify the inquiry in the first instance, the resistance of the engine was put aside, and the investigation was directed exclusively to the resistance of the train. Various methods presented themselves for testing this. The most direct method was the application of an instrument called a dynamometer in front of the train, by which the train could be drawn, and which would afford a direct measure of the force with which it was so drawn. This method, however, was subject to several objections. It was found that the surface of the rails, commonly regarded as level, were really subject to variations of inclination through small distances, which produced upon the dynamometer sudden jerks, which caused its index to play between such extreme limits as to render it impossible to arrive at any useful mean of its indications. Besides this, if such an instrument were used to estimate the resistance of a train, moving with any considerable speed, it must necessarily be placed between the engine and the train, and would therefore show only a modified effect of the atmospheric resistance; inasmuch as the engine would have already encountered and removed a portion of that resistance before the instrument could be effected by it. Numerous experiments were nevertheless made with such instruments, and it was not abandoned until its failure was rendered practically manifest. Another method occurred to Dr. Lardner for determining that portion of the resistance which is due to friction, by attaching to an engine such a load as the engine is capable of moving, at a slow uniform velocity, up a given inclined plane, and then taking the same load to a more steep inclined plane and detaching from it as many wagons as would enable it to move up the steeper inclined plane at the same slow speed as that at which it moved up the less steep inclined plane. Under these circumstances it might be safely assumed, that the absolute resistance to the engine would be in both cases the same, and the difference of the gravity of the two inclined planes would, in such a case, by the aid of mathematical principles, and by formulæ, which Dr. Lardner constructed, give the resistance due to the wagons detached in passing from the less to the more steep inclined plane. This method would be attended with the advantage of giving a result, in a great degree, free from the atmospheric resistance, and therefore would furnish a near approximation to the value of the friction, properly so called. As the motion would be slow, and a part of the train would be in front of the wagons detached, the atmospheric resistance would necessarily have but a very slight effect. As no opportunity, however, presented itself of executing experiments upon this principle, he did not occupy the time of the Section in enlarging upon it.

After much consideration, he arrived at the conclusion, that the method of investigation which was calculated to give the most satisfactory results as to the resistance of railway trains was, by observing their motion down steep inclined planes. This method had been already practised, and its principles will be easily rendered intelligible. If a body be placed on a steep inclined plane, and allowed to descend it by the force of its gravity, its motion down the inclined plane would be accelerated. If the causes of the resistance affecting the body were uniform in their effect, and independent of the velocity, then the motion of the body down the inclined plane would be uniformly accelerated, just as a body falling freely and perpendicularly by gravity would, apart from the atmospheric resistance. By being uniformly accelerated, is meant this, that the increase of velocity which takes place every second of time is the same. Thus, whatever velocity is

acquired by the body at the end of the 1st second, having descended from a state of rest, twice that velocity will be acquired at the end of the 2d second, and thrice that velocity at the end of the 3d second, and so on. It is evident, therefore, that a body, subject to such acceleration, would go on increasing its speed without any limitation. As the intensity of the force of gravity is exactly known, and as the effect produced in diminishing that intensity by a plane of given inclination is a matter of easy and exact calculation, nothing can be more certain than the computation of the motion which a body would have down an inclined plane if that body were subject to no resistance. Now, if it be subject to resistance, the comparison of its actual and observed motion, with the motion which it would have, being subject to no resistance, computed, as just explained, ought to supply means of determining the amount of the resistance; but to do so it is necessary to know, to a certain extent, the law of the resistance which is in operation.

The resistance arising from attrition or friction, whether it be of surfaces rubbing one on another in the manner of a sledge, or rolling one on another as the tire of a wheel rolls upon a rail, or subject to the kind of attrition which takes place between the axle of a wheel and its bearings, have been all submitted to most elaborate and careful experimental inquiry; and the laws of the resistances, arising from these, have been fully and clearly developed. The question of friction was formerly investigated by Coulomb, Ximenes, Vince, and others; but recently a more extensive and valuable series of experiments on the subject, than was ever before executed, has been made, under the order of the French government, by M. Morin, and their details made public. The results of these fully corroborate the laws which had already resulted from the inquiries of the philosophers who before examined the subject, which laws are as follows:—1st, the resistance arising from friction, whether of rubbing or rolling, or that between the axle of a wheel and its bearings, are, when other things are the same, independent of the velocity; 2d, other things being the same, these resistances are directly proportional to the amount of pressure on the rubbing surfaces, and independent of the magnitude of these surfaces. To these laws, taken within practical limits, there can scarcely be said to be an exception. The extreme cases which become exceptional, having no application whatever to the present inquiry, it will not be necessary to regard them.

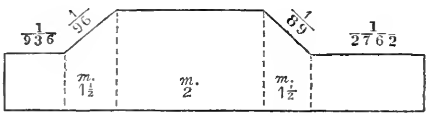
The immediate consequence, from the friction being the same at all velocities, is, that it is a uniformly retarding force, that is to say, that it destroys in the moving body on which it acts equal velocities in equal times. Thus, if it destroy a certain amount of speed at the end of one second, it will destroy twice that at the end of two seconds, three times at the end of three seconds, and so on. Now if a railway train, moving down a steep inclined plane, were subject to no other resistances than those arising from friction, it is evident that it would move down the plane with a uniformly accelerated motion, although that motion would be less accelerated than if it were subject to no resistance. In other words, the *kind* of motion affecting it would be the same as if there was no resistance, the *degree* of motion alone being altered. It has been stated that, subject to no resistance, certain speeds would be gained by the train in one, two, three, seconds. These speeds would be those due to the gravity of the plane. These speeds would, however, now be diminished by the amount of velocity destroyed by the friction; and as this latter would be increased in the same proportion as the speed imparted by gravity, the descending body would be accelerated by a uniform force, equal to the difference between the acceleration of gravity

and the retardation of friction. In a word, both of these being uniform and independent of the velocity, their difference, that is, the effective accelerating force, down the plane will be uniform and independent of the velocity.

Such was the reasoning on which was based all former investigations of the resistance of railway trains, by observing their motions down inclined planes. The acceleration due to gravity was calculated; the actual acceleration moving down the plane was observed, and the difference was supposed to give the retarding force due to the resistance. It is evident that by such a mode of proceeding, the effect of the atmosphere, or of any other cause which produced a retardation increasing with the speed, was either neglected, or was considered to be of such trifling amount, compared with the resistance due to friction, that it might be regarded as involved in the estimate of resistance thus obtained with sufficient accuracy for practical purposes. Such, indeed, was the impression on Dr. Lardner's own mind when he commenced this investigation, and he accordingly proceeded on the same principles as those adopted by other inquirers, except that in the formulæ he included the effect of the gyration of the wheels, which was neglected in the calculations of M. de Pambour, and which omission entailed an error upon his results.

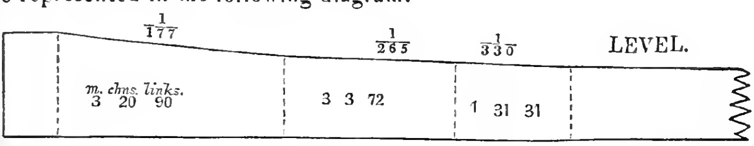
With a view to determine the actual acceleration of a train down an inclined plane, the Whiston and Sutton inclined planes on the Liverpool and Manchester Railway, and a series of inclines on the Grand Junction Railway, extending from Madeley for several miles towards Crewe, were selected. This figure represents the inclined planes on the Liverpool and Manchester Rail-

LEVEL.



way. The summit level which lies between them is about two miles in length; the Whiston inclined plane descends towards Liverpool, falling at the rate of 1 in 96 for about a mile and a half, and is succeeded by an inclination which rises at the rate of 1 in 936 for a considerable distance. The Whiston and Sutton inclined plane falls, towards Manchester, at the rate of 1 in 89 for about a mile and a half, and is succeeded by a portion of the line nearly level, for a considerable distance towards Manchester.

The first plane on the Grand Junction line descended from the Madeley summit towards Crewe, falling at the rate of 1 in 177 for a distance of three miles and a quarter; this is succeeded by another which falls at the rate of 1 in 265 for a distance of rather more than three miles, which is succeeded by another falling 1 in 330 for a distance of nearly a mile and a half. This last is succeeded by a level, which continues for several miles. These planes are represented in the following diagram.



The Whiston and Sutton inclined planes on the Liverpool and Manchester line, are straight thoughout nearly their whole length. The Madeley inclines, represented in the diagram, are, in some places, curved with a ra-

dius of a mile, turning alternately to the right and to the left; but considerable portions of them are straight. A stake, marked 0, was placed at the summit of each inclined plane, and the length of the plane descending was divided out by stakes marked successively, 1, 2, 3, &c., into spaces of one hundred yards. Watches, by which a second could be without difficulty bisected, were provided, and the moment of passing the successive stakes was observed to be within, at the most, half a second of the truth. Every care was taken to confer the last degree of accuracy upon these observations; one person was employed to call out the moment of passing each stake; another, supplied with a watch, declared the time, and the third took it down; and in many cases these were checked by having two sets of observers.

A few experiments conducted in this manner soon made it manifest that the motion down an inclined plane was not, as has been hitherto supposed, uniformly accelerated. It was found, for example, that the increase of speed in each successive interval of time was not the same, but was continually less as the motion increased. In other words, the degree of acceleration *was gradually diminished*. Now this was an effect evidently indicating an increase of resistance with the increase of speed, and naturally suggested the idea that the atmosphere must have had a more considerable effect than had been supposed. The mathematical formulæ, commonly used for the determination of resistance, are founded, as has been already stated, on the supposition that the resistance is independent of the speed. These formulæ were now applied to the motion of the train down the inclined planes for short distances, measured from the points at which the trains were respectively started, so that within the range of their application the train might acquire but very little speed, and therefore that the result might be only slightly affected by the atmosphere. The results of such calculations, applied to the motion of the train for 100, 200, or 300 yards, were found to give a resistance, amounting to from the 400th to the 450th of the load. This was not half the amount of the common estimate of the resistance to railway trains, which was about the 250th part of the load, that resistance having been assumed to be the same at all speeds. It occurred to Dr. Lardner now to attempt an approximation at the resistance by another process, as follows:—trains were brought to a level and straight line of railway, and, being driven by an engine until they attained a speed of 30 to 35 miles an hour, they were dismissed, and allowed to run until, being gradually retarded, they were brought to rest. The line being staked out as before the moments of passing, the successive stakes were observed, and the rate at which the train was retarded by the resisting forces was observed, for each 100 yards over which it moved; a calculation was made of the amount of resistance by the usual formulæ, founded on the supposition that the resistance is independent of the speed; but these calculations being confined to the first 100, 200, or 300 yards, might be considered as giving a fair approximation, since the change of velocity throughout that distance was not very considerable. The result of such observations indicated a resistance amounting to from a nintieth to a hundredth of the load. It will be observed that in these last cases the velocity of the train, at which the resistance was computed, was very considerable, while, in the former cases, taking the initial motion down an inclined plane, it was very small. The inference, of course, which followed, supposing such calculations to give correct results, was, that the actual resistance at high speeds was many times more than when the motion is slow. Since, however, these methods of calculation could be regarded as only ap-

proximative, and were, in fact, based on principles which were only true on the supposition that the resistance was independent of the velocity, which supposition was contradicted by the results of the calculations themselves, it was considered necessary to resort to some other and more correct method of determining the resistance.

If it be admitted that the atmosphere produces any considerable resistance, since that resistance must increase in a very high ratio with the speed, it would follow, that if an inclined plane of sufficient length could be obtained, the motion of a train would continue to be accelerated until it would obtain a velocity which would produce *a resistance from the air, such as, combined with friction, would be equal to the gravitation down the plane.* When such a velocity should be attained, the moving force down the plane, being equal to the resisting force, no further acceleration would take place. As it was thought, however, that the inclined planes, which were accessible, might be not of sufficient length to produce this effect with such trains as it was possible at that time to obtain for experiments, it occurred to Dr. Lardner that the end would be equally attained by starting the train from the top of the inclined plane at a considerable speed; that thus, the acceleration it would receive while descending being added to its initial speed, might be expected to give that velocity, at some point of the descent which would be attended by a resistance equal to the gravitation of the train down the plane; at which point, therefore, acceleration might be expected to cease, and a uniform motion to be maintained to the bottom of the plane.

The first experiments tried with this view were completely successful, and the result obtained was in exact accordance with what had been anticipated. On the summit level of the Liverpool and Manchester Railway, marked in the diagram, No. 1, a train of four carriages was placed, and was drawn by an engine to the top of the Whiston plane ($\frac{1}{96}$) from whence it was started at a considerable speed. Its motion was accelerated for a short distance, but soon became perfectly uniform; and it descended through the greater part of the plane at the uniform velocity of 31.2 miles an hour. This experiment was again repeated with the same coaches, increasing the load. As was expected from the gravitation of the increased load, a greater velocity was now obtained; but still a uniform velocity resulted, and the train descended the plane with the most perfectly uniform motion, at 33.72 miles an hour. These experiments were tried repeatedly on the same day with the same results. A moderate wind blew down the plane, so that the inference was, that this train, in a calm atmosphere, would have suffered a resistance greater than a ninety-sixth part of its weight, at the velocities above mentioned. This experiment, with a train of four coaches, was repeated on the Sutton plane, and on the inclines near Madeley, represented in the diagram; and in every case a uniform velocity was obtained—this velocity diminishing with the steepness of the plane.

When these first experiments became known, one of the objections brought against them was, that a train of four coaches was so light, that a moderate atmospheric resistance would retard it: and that as, in the practical working of railways, such trains were never used, the results obtained had no practical utility; and that with heavy trains, such as those actually used on railways, no such results would ensue. This objection, among others, was advanced in a Report published by Mr. Brunel, the engineer, of the Great Western Railway. In order to meet this objection, trains of greater magnitude were subsequently tried, and the same results ensued—a uniform velocity being attained in every case in which the train could be

started from the top of the plane with a sufficiently high speed. In the following table is exhibited the mean results of a vast number of experiments tried with trains of four, six, and eight coaches. In the third column, the letter expresses generally the state of the wind—F fair, A adverse, C moderately calm, and CC a dead calm; the fourth column gives the gradient down which the motion took place; and in the last column is expressed, in miles per hour, the uniform velocities which the train attained, and which it preserved through a length of the plane sufficiently considerable to show that it would not have received any further increase.

Number of Coaches.	Weight.	Wind.	Gradient.	Uniform velocity attained.
	Tons.		One in	Miles per h.
4	15.6	F	96	31.2
4	18.	F	96	33.72
4	18.	F	177	21.25
4	20.5	F	177	22.9
4	20.5	F	89	38.25
4	20.2	F	265	19.13
6	27.5	A	89	32.3
6	27.5	F	89	37.5
6	27.5	F	96	34.6
6	27.5	A	96	27.8
6	34.5	C	89	35.3
8	36.5	F	89	>36.5
8	40.75	F	177	26.15
8	40.75	S	177	<17.7
8	40.75	CC	89	31.4

The last experiment with a train of eight coaches, weighing nearly forty tons, shows that in a dead calm, the resistance of *that train at* 31½ *miles an hour amounted to the eighty ninth part of its weight; whereas the common estimate of the resistance of such a train at that speed has heen hitherto about the* 250*th part of its weight!* This fact alone, were it unconnected with any others, would sufficiently illustrate the enormous extent of error which has prevailed hitherto in such estimations in railway practice. The third experiment with eight carriages was made with a side wind, the effect of which is abundantly manifested by the speed expressed in the last column. While the same train, moving with a fair wind down the Madeley plane, had a resistance equal to the 177th of its weight, at 26 miles an hour, its resistance with a side wind was of greater amount at 17.7 miles an hour.

The relative effects of a fair and adverse wind, are likewise exhibited in the third and fourth experiments with six coaches, down the Whiston plane. The velocity which gives a resistance equal to the 96th part of the load, was 34½ miles an hour with a fair wind, and only 27¾ with an adverse wind.

When the first experiments indicating these results became public, various objections were urged against them by Mr. Brunel; and although it was not considered by Dr. Lardner, or by any of the other persons engaged in this inquiry, that such objections were entitled to any serious attention, yet it was thought advisable to make experiments which would show whether or not they had any foundation in truth. One of these objections was the following: that the cirumstances under which such experiments were performed,

were not really, though they were apparently, similar to those of an ordinary train in motion; that the carriages were here sent with the square end foremost, to meet and receive the full resistance due to their surface, which is totally different from the case in which the engine precedes them.* The engine in front, it was stated, would act as a sort of cut-air, or bow, and thus destroy or diminish the resistance produced by the flat front of the carriages moving foremost. In order to ascertain the full value of this objection, Dr. Lardner took an engine, 'The Fury,' with her tender, and obtained two coaches, weighed so as to be nearly equal in weight to the engine and tender. The connecting rods and working-gear of the engine were detached from the driving wheels, so that the engine should be subject to no other friction save that which a coach is subject to. The Fury and its tender, and these two coaches, thus prepared, were placed successively at the summit of the Sutton plane, falling $\frac{1}{89}$ towards Manchester, on the Liverpool and Manchester Railway; and they were allowed to descend by gravity. The circumstances of their descent were found to be, in all respects, alike, passing corresponding stakes at very nearly the same time, and very nearly the same speed. The full particulars of this, and other experiments, will be published; but, in the meanwhile, the principal results of this experiment are exhibited in the following table:—

	Weight.	Total distance run.	Time of running total distance.		Greatest speed.	Total of descending the Sutton plane. 1.89	
	Tons.	Yards.	m.	s	m. p. h.	m	s.
Fury and Tender	11.39	4.710	11	37	29	4	29
Two coaches	11.33	4.577	11	40	28.12	4	24
Difference	.06	.133	0	3		0	5

It appears, therefore, that the difference in the whole distance run by the coaches, and by the engine and tender, amounted to only 133 yards, in a distance little short of three miles; and that there was only three seconds difference in the time. The maximum speed attained was nearly the same; and the time of descending the inclined plane only differed by five seconds. This difference, such as it was, was in favor of the coaches with their flat front. In fact, the differences of the numbers in the successive columns of the above table, are only such as would take place in the same experiment tried twice successively with the same coaches.

TO BE CONTINUED.

Sulphur Monopoly.

In consequence of the monopoly of sulphur in the Island of Sicily, granted to the king of Naples, the English have turned their attention to the extraction of this material from its native compound which exists abundantly in every country in which metallic ores abound. It may be that a resource

* Mr. Brunel's Report to the Directors of the Great Western Railway Company, 27th Dec. 1838, p. 9.

of this kind will be found advantageous in the United States, where the sulphurets of iron, lead, and probably of other metals, exist in profusion.

The effect which this monopoly has had, (says the Mining Journal,) will, in the end, we are satisfied, be highly productive to the mines of this country; attention having been directed to the sulphur ores, which are found so abundant in our mining districts, in combination with other metallic substances. We had occasion to note that mundic was now being shipped to the chemical works in the north, and a remunerative price given per ton, and, to our knowledge, we may add, that contracts to the extent of some thousands of tons have been entered into of late, for the supply of sulphur ores from Cornwall and Ireland. The circumstance of this hitherto valueless substance being now found to be applicable to the manufacture of sulphur, induces us to hope, as we verily believe, that, ere long, we may be independent of Sicily and other parts from whence this article is imported into this country. Min. Jour.

Novel Wind Engine.

We have been much gratified this week in examining a wind engine for fen drainage upon a very improved construction. The object of the inventor (Thomas Brighty, Esq., of Ramsey) seems to have been to produce a machine that shall not be affected by the head thrown against it, to render the least motion of the air available to raise a corresponding weight of water, which may be increased exactly in proportion to the strength of the wind, and (what is entirely a new feature in the above machine) it may be safely left "to take care of itself," requiring only occasional attendance; it clothes itself when the water is high, and when low, unclothes and stops; and let the wind be ever so strong, it cannot stir until the water has again risen to a certain pitch; then, if the wind is sufficiently strong, it clothes and sets itself in motion, and continues going until the water is reduced to a certain level, when it at once unclothes and stops. The machinery is extremely simple, and not subject soon to get out of repair.—*Cambridge Independent.*—[We believe there is nothing novel in the application of the windmill, or wind engine, whether as regards Cornwall or North Wales, having seen them applied to the purposes of drainage in both. In the neighbourhood of Holywell is one erected, if we mistake not, by Messrs Rigby, at a lead mine, which is most perfect and simple in its construction, requiring little or no attention; it turns with the wind, shuts up shop, and does all that is necessary to render it serviceable; it is of great power, and used for working crushers or grinders. Mr. Concanen also gave a description with an illustration, in the *Mining Journal,* some time since, of an improved wind machine.—Ed. M. J.]
Ibid.

Extraordinary Blast.

The workmen at present employed by his Grace the Duke of Buccleugh, at Boykine Craigs, in the parish of Westerkirk, near Langholm, on a trial for a slate quarry, have frequently been required to blow away part of the adjoining whinstone rock by means of gunpowder. A few days ago they had bored the rock to the depth of three feet, and charged with about 2 lbs. of powder, which, when it exploded, lifted out a block of stone measuring $3\frac{1}{2}$ feet square, and threw it to the distance of fifty-one yards at a single bound. What renders this the more astonishing is, that the block was closely wedged in on all sides but the front, and the bottom was broken completely out of

solid stone. By the usual mode of calculation it cannot weigh less than $3\frac{1}{2}$ tons, and now lies on the spot where it was thrown out of the quarry for the inspection of the curious. Ibid.

Consumption of Coal and Iron at Bordeaux.

Bordeaux consumes annually 5,000,000 kilogrammes of iron—of which quantity 500,000 kilogrammes are imported from England, and 200.000 from Sweden. The rolled iron comes principally from England and Angouleme; the thin steel-iron is also supplied chiefly from England. There are about from 5000 to 6000 boxes of sheet tin used annually in Bordeaux; one house alone sells nearly 3000, and the whole of it is of English manufacture. There are two depots for sheet copper at Bordeaux, the consumption of which is very great for the sheathing of ships, and a great deal is also used by the manufacturing braziers. The quantity of coal consumed at Bordeaux, does not exceed 241,340 quintals—of which 200,000 are imported from England. This small comparative consumption of coal, arises from the proximity of the pine forests, which supply an excellent combustible at much less price than coals can be purchased. Ibid.

On Browne's Patent Hydraulic Level. By A. F. Hemming.

This instrument designed for ascertaining the relative heights of points not visible from each other, consists of lengths of water-tight flexible tubing, attached to each other by brass joints, and having glass vessels at each end. The vessels and tubing being nearly filled with water, the level of the water, as seen in these vessels at two points whose relative heights are to be compared, will serve to indicate their positions, whatever may be the inflexions of the tubing betwixt the two vessels. Graduated rods are placed perpendicularly at the points of observation, and the lower vessel is raised, and the higher lowered, until the level of the fluid therein intersects the graduation of the rods. It is conceived that this level may be peculiarly useful to mines and excavations, and in fixing complicated machinery. Transactions of Civil Engineers.

Railway Property as an Investment.

A correspondent calls our attention to the extraordinary increase in the value of railway property, which has taken place within the last six months. Comparing the quotations in our share list of the 14th December last, with those of the 13th inst., it will be seen that upon twenty lines this increase amounts to upwards of *eight millions sterling!* Thus the Great Western shares in that period have risen 52*l.* per share, namely, from 10 discount to 42 premium, equal to 1,300,000*l.* upon the 25,000 original shares; the new shares have risen from 5 discount to 20 premium, equal to 625,000*l.*—making altogether 1,950,000*l.* upon the old and new shares. The London and Birmingham shares have in like manner risen from 50 premium to 99 premium, equal to 1,225,000*l.* upon the 25,000 original shares; the quarter shares have risen from 22 to 30 premium, equal to 200,000*l.*; and the new shares have risen 13*l.*, equal to 405,950*l.*—making altogether upon the shares a sum of 1,830,950*l.* The shares of the other lines in the following table are computed in the same manner:—

Great Western, . . .	£1,925,000
London and Birmingham, . .	1,830,950
Grand Junction, ...	829,000
London and South-Western, .	612,000
Eastern Counties, ...	488,000
North Midland, ...	420,000
London and Brighton, . . .	360.000
Manchester and Leeds, . . .	312,000
Midland Counties, ...	240,000
Manchester and Birmingham, .	180,000
London and Croydon, . . .	165,000
Carried forward, . . .	£7,321,950
Brought forward, .	£7,321,950
Great North of England, . .	150,000
London and Blackwall, . .	120,000
York and North Midland, . .	120,000
Birmingham and Gloucester, .	95,000
Chester and Crewe, ...	90,000
Bristol and Exeter, ...	90,000
Cheltenham and Great Western,	75,000
Birmingham and Derby, . .	63,000
London and Greenwich, . .	60,000
Total improvement in value,	£8,166,950

These results cannot fail, as our correspondent remarks, to be most gratifying to railway proprietors, as showing that public opinion has undergone a change; that railways are no longer viewed with suspicion as the mere speculations of a day, to be spoken of in the same breath with Spanish bonds and American state paper, but that they are regarded as real and valuable investments in the soil. Railway Times.

Mechanics' Register.

Unwoven Cloth and Glass Tapestry.

This French device must have very remarkable results. Two specimens of it were exhibited at the Marquis of Northampton's last *soiree*, as President of the Royal Society, and they then excited the curiosity and astonishment of the assembled *elite* of our philosophers. They were rich silk curtains, having all the appearance of being inwoven in gold and silver in most gorgeous patterns of arabesque. They looked and felt exactly like the most splendid hangings of the Louis Quartorze; but their cost is a mere trifle in comparison; for the *gold* and *silver* are merely *woven glass*. The Queen of the French and her daughters appeared at the last balls in the Tuilleries in dresses manufactured upon this principle. John Bull.

Locomotive Carriage.

Mr. Hill lately made a very successful trip to and from Camberwell and Brighton with his patent locomotive carriage; the distance from Camberwell to Brighton was performed in 5 hours and 10 minutes, out of which time 1 hour 21 minutes was lost by delays in obtaining a supply of water at the inns, and 10 minutes delay on the road. The return trip was accomplished in 5 hours 22 minutes, out of which time 1 hour 4 minutes was lost by delays in obtaining water, and 26 minutes delay by stoppages on the road; the delays in obtaining water will be reduced very considerably, when proper stations and stated periods for arrival are made, the whole of the stoppages need not occupy more than 12 minutes, which, according to the speed the carriage ran on the road, the journey from London to Brighton might be very well accomplished in about three hours and a half. Our correspondent, who accompanied Mr. Hill on his trip to London, states that the form of the carriage is a handsome britzka, that there is scarcely any noise from the working of the engine, or escape of steam, and no appearance of smoke; on descending hills

it is easily regulated by powerful retarders, and guided with the greatest facility. We hope at some future time to be able to give some additional information connected with the cost of a carriage, and the working of the same.

Arch. Jour.

Dredging the Thames.

It is a remarkable fact, that notwithstanding the enormous sum of £125,000 was expended in dredging the river Thames, off Woolwich, between the years 1808 to 1816, the river is now in as bad a state as ever, and the mud and silt are accumulating instead of decreasing. In 1816 alone, as much as £29,000 was thus expended, and the sum amounts on an average to £16,000 per annum to such little purpose.

Naut. Mag.

New Steam Vessel.

Experiments are in the course of being tried with the model of an entirely new form of steam vessel, and, as far as they have yet gone, with every prospect of a successful result. At present we can only state of this remarkable invention, that there are no paddle wheels, nor external works of any kind. The whole machinery is in the hold of the vessel, where a horizontal wheel is moved by the power of steam, and acting upon a current of water, admitted by the bow, and thrown off at the stern, propels the mass at a rapid rate. By a very simple contrivance of stopcocks, &c., on the apparatus, the steamer can be turned on either course, retarded, stopped, or have her motion reversed. This will be literally a revolution in the art of steam navigation.

Literary Gazette.

Fourdrinier or the Continuous Paper-making Machine.

Dr. Ure, in his Dictionary of Arts and Manufactures, observes that, "nothing can place the advantage of the Fourdrinier machine in a stronger point of view than the fact of there being 280 of them now at work in the United Kingdom, making collectively 1600 miles of paper, of from 4 to 5 feet broad, every day; that they have lowered the price of paper 50 per cent., and that they have increased the revenue, directly and indirectly, by a sum of probably 400,000*l.* per annum.

Mech. Mag.

"*Mode of Dowelling Timber, or of combining it and other materials for general purposes.*" By M. J. Brunel, M. Inst. C. E.

The author proposes to unite timber by means of iron dowels and asphalte. Mastic had been used in the Tunnel works for the purpose of fitting small plates of cast-iron to the poling boards. These, though constantly immersed in water and mud, and subject to severe hammering, had stood perfectly well. Asphalte is now used in preference to mastic, as it sets immediately. The author conceives that stone may be united by a similar kind of dowelling; and that wood may be interposed between stone and iron, so as to be used to advantage with the stone blocks, for the chairs of railways. Also, that this method may be used with great advantage in ship-building, in mast-making, and wherever any species of dowelling is required.

Lond. Jour. Arts & Sc.

LUNAR OCCULTATIONS FOR PHILADELPHIA, DECEMBER, 1840.					Angles reckoned to the right, or westward, round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
1	10	2	Im. N. Aquarii,	6	94°	140°
1	10	57	Em.		330	20
14	13	52	Im. *q* Tauri,	5,6	121	77
14	14	21	Em.		169	126
14	14	54	Im. 76 Tauri,	6	96	57
14	15	48	Em.		187	137
27	7	39	Im. *d'* Capricorni,	6	102	148
27	8	36	Em		320	10

Meteorological Observations for July, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	65	74	29 80	29 82	W.	Brisk.		Clear—cloudy.
	2	60	72	.95	77	W.	Calm.		Cloudy—do.
	3	62	66	30.00	30.00	N.E.	do.		Cloudy—do.
	4	57	80	.02	.04	W N W.	Brisk.		Partially cloudy—clear.
	5	60	81	.12	.12	E	Calm.		Lightly cloudy—clear.
☾	6	61	72	.12	.10	N.E	do.		Partially cloudy—rain.
	7	63	68	.00	30 01	N.E.	Moderate.	.39	Rain—cloudy.
	8	64	72	.00	29.95	S E.	do.		Cloudy—do.
	9	70	75	29.80	.80	W.	do.	.35	Cloudy—rain.
	10	65	83	.80	.75	W.	do.		Clear—do.
	11	65	85	.90	.93	W.	do.		Clear—do.
	12	66	87	.90	.90	S W.	Calm.		Lightly cloudy—do.
	13	67	75	.75	.94	S.W.S.E	do.	.34	Partially cloudy—showery.
☉	14	73	85	.60	.63	W.	do.		Flying clouds—do.
	15	69	89	.76	.83	W.	Moderate.		Clear—do.
	16	70	91	.87	.90	W.	Calm.		Clear—do.
	17	74	89	.90	.87	S.W.	Moderate.		Fog—clear.
	18	76	82	.85	.85	S W N.E	Calm.	.27	Cloudy—shower.
	19	72	88	.83	.91	W.	do.		Cloudy—clear.
	20	65	77	.87	.93	N.E.W	do.		Clear—do.
	21	62	82	.93	.96	W.	do.		Clear—do.
☽	22	63	86	30.00	30.02	S.W	do.		Clear—do.
	23	64	72	29 98	29 85	S.	do.	.41	Cloudy—showery.
	24	70	80	.57	.59	W N W.	do.		Cloudy.—do.
	25	65	82	.81	.95	N.W.	do.		Partially cloudy—do.
	26	64	84	30.01	30 05	S W.	do.		Clear—do
	27	64	86	.05	.05	S W	do.		Partially cloudy—clear.
	28	65	86	.03	29 95	S W.	do.		Clear—flying clouds.
⊗	29	75	86	29.77	80	W.	do.		Cloudy—clear.
	30	66	85	.96	30 00	W.	do.		Hazy—clear.
	31	70	79	31.00	.00	W.	do.		Fog—cloudy.
	Mean	70.06	80 42	29.90	29.90			1.76	

	Thermometer.		Barometer.
Maximum height during the month.	89.00	on 15th and 17th.	30.12 on the 5th.
Minimum " "	57 00	on 4th.	29.57 " 24th.
Mean	75 24		29.90

// JOURNAL

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Civil Engineering.

Letters from the United States of North America on Internal Improvements, Steam Navigation, Banking, &c., written by FRANCIS ANTHONY CHEVALIER DE GERSTNER, *during his sojourn in the United States, in* 1839.

(Translated from the German, by L. KLEIN, Civil Engineer.)

LETTER III.

Wilmington, North Carolina, March 31*st*, 1839.

Post Office Department, Transportation of the Mail in Steamboats and upon Railroads.

The Post Office department forms in the United States an important branch of the administration of the General Government; the principle has been adopted that the surplus of receipts over the expenditure shall be applied to the establishment of new post roads; the General Government derives, therefore, no increase of revenue from this branch of the public service. The whole Post Office department is superintended by a Postmaster General, who is a member of the Cabinet of the President of the United States; but, like the other cabinet officers, receives only the moderate salary of 6000 dollars.

The Postmaster General appoints all the Deputy Postmasters and their assistants, throughout the Union; and dismisses them at his discretion. The Postmasters have no fixed salaries, but receive a per centage of the income to an amount not to exceed 2000 dollars a year. The transportation of the

mail is let by contract to stage proprietors, or to railroad and steamboat companies; on less frequented roads the mail is carried on horseback or in sulkies, also by contract. The transportation of passengers, of small packages, and other objects, except the mail, is left to private enterprise, and privileged postholders no where exist. The length of the postroads in 1838, was, according to the Postmaster General's report, 134,818 miles; the number of post offices, 12,519, and the number of miles the mail has been carried in the last three years, were as follows:

Transportation of the Mail.

Year.	Upon common roads.	On horseback and in sulkies.	Upon railroads and in steamboats.	Total number of miles.
1836	17,408,820	8,291,504	1,878,296	27,578,620
1837	18,804,700	11,999,282	1,793,024	32,597,006
1838	20,593,192	11,573,918	2,413,092	34,580,202

In the year 1838 the transportation of the mail was let to 1947 individuals or companies, and the expenses have been:

Year 1838.	The mail was transported.	Expenses of transportation.	Expenses per mile of single transportation.
	Miles.	Dollars.	Cents.
Upon common roads, . .	20,593,192	1,889,792	$9\frac{1}{6}$
On horseback and in sulkies, . .	11,573,918	831,028	$7\frac{1}{6}$
Upon railroads and in steamboats,	2,413,092	410,488	17
Total, . . .	34,580,202	3,131,308	11

These statements serve to show the immense extent of the post arrangements in this country, and the increase in the transportation of the mail upon railroads and in steamboats. In 1832 the mail was carried 499,301 miles upon railroads and in steamboats; 6 years later the number of miles had increased to 2,413,092, or five-fold.

The Government considers railroads as private property, and each contract for the transportation of the mail upon them is therefore made with the free consent and agreement of both parties. Congress had up to this time only determined that the maximum compensation allowed to railroad companies should not exceed 25 per cent. over that allowed on common roads, upon which the mail is carried so much slower. The transportation of the great Western mail, between Baltimore and Cincinnati, costs annually 190 dollars per mile of road, for which sum the contractor has to carry the mail daily once in each direction. The addition of 25 per cent. gives $237\frac{1}{2}$ dollars as the amount, which is paid to most of the railroad companies; this is equal to $32\frac{1}{2}$ cents for the transportation of the mail a single time one mile; an amount which might be reduced to one-half in Germany, in consequence of the prices of all articles being there smaller in the same proportion. The railroad companies here were dissatisfied with the above compensation, and declared their unwillingness to transport the mail any longer for the same; Congress, in its present session, has, therefore, authorised the Postmaster General to increase the compensation to 300 dollars per mile per

year; this gives for a single transportation of the mail, one mile, 41 cents. It is to be remarked, however, that upon railroads the great mails are principally carried weighing from 2000 to 3000 pounds, while with stages the mails are generally smaller. The high price allowed to the railroad companies shows sufficiently that it is regarded here as highly important to have the mail carried upon railroads in preference to other conveyances.

The railroad companies are on their part bound to keep the time prescribed by the Postmaster General, and they lose the compensation for a whole day if the mail arrives once later than at the specified hour.

Management of Railroads in Winter.

The majority of the American railroads are located in the northern States, where in winter the canals are frozen during four months, and the snow often falls several feet deep. As the railroads frequently pass through deep cuts, the difficulties occasioned by the snow are much increased. After many experiments, a proper apparatus has been invented, which has been found to answer very well. This machine clears the snow, and breaks and clears the ice off the rails. If the snow lays only a few inches deep, the apparatus is attached to the locomotive, and the train starts at the usual hour; but when the snow is deeper, a separate engine is despatched with the apparatus, in advance of the train, to clear the track. Parts of the Utica and Schenectady Railroad were covered with snow last winter, from three to four feet in depth; two, and once three, engines were sent from the depot, which, being connected together, moved the apparatus before them, and cleared the track. In this way they succeeded in overcoming the obstacle entirely, and in making the trips regularly and in the usual time.

Precaution is also necessary with the *locomotive engine,* to prevent the pumps and pipes from freezing, and to protect the engineman and fireman from the frost. The engine is therefore put under cover, and engineer and fireman stand under a tent of canvas, which covers part of the engine and tender. Two windows in front allow the engineer to overlook the road and engine, while the access of the cold air is almost entirely prevented, and men and engine are safe from frost and snow. The passengers are transported in long eight-wheeled cars, containing each from fifty to sixty seats, and a stove, to heat the car comfortably. On each end of the car is a platform, over which it is easy to get from one car to the other during the journey, and to visit one's friends and acquaintances. Some cars contain a bar with refreshments; others have separate apartments for ladies, in which they are attended by female servants; finally, they have gone so far as to construct a car with forty-two beds, that the passengers may quietly sleep during their night journey, which beds are transformed into seats in the day time. A railroad car here, resembles, therefore, a steamboat; on board of it, (as the Americans say.) one may have all the comforts of the latter, and accomplish an agreeable journey, without being subject to sea-sickness.

The longest Railroad connection in the United States.

In my second letter I took occasion to make mention of the most expensive railroad in this country. I shall now speak of the longest railroad connection, in order to show that the American railroads are not short, not without connection with each other, and not constructed for pleasure travelling only, but that they are regarded as great thoroughfares, as connecting the most distant points of the Union, and are principally used by business men.

The railroad which may be regarded as the longest in the world, extends from Boston, in Massachusetts, to Greensboro', in Georgia, and is composed of the following sections:

From.	To.	Communication.	Distance in miles.	Weight of rails.	No. of locomotives.	Cost of construction.	
						Whole road.	Per mile.
						Dollars.	Dollars
Boston	Providence	railroad	42	55 lbs.	11	1,600,000	38,095
Providence	Stonington	do.	47½	58 "	6	2,500,000	52,632
Stonington	New York	steamboat	130				
New York	New Brunswick	railroad	31	38 "	7	1,752,200	56,522
N. Brunswick	Trenton	do.	27½	41 "	4	497,800	18,102
Trenton	Philadelphia	do.	30	13 "	4	400,000	13,333
Philadelphia	Wilmington, Del.	do.	28			500,000	17,857
Wilmington	Havre deGrace	do.	35	35 "	14	800,000	22,857
Havre deGrace	Baltimore	do.	36	40 "		950,000	36,390
Baltimore	Washington	do.	39	40 "	4	2,040,330	52,316
Washington	Aquia Creek	steamboat	60				
Aquia Creek	Fredericksburg	stage	13				
Fredericksburg	Richmond	railroad	61½	10½ "	12	1,200,000	19,512
Richmond	Petersburg	do.	22½	9½ "	5	700,000	31,111
Petersburg	Weldon	do.	60	9½ "	12	766.267	12,771
Weldon	Wilmington, N.C	do.	160	12 "	10	1,360,000	8,500
Wilmington	Charleston	steamboat	160				
Charleston	Augusta	railroad	136	25½ "	27	2,000,000	14,706
Augusta	Greensboro'	do.	84	17 "	10	1,176,000	14,000
			1203				

Note. Between Aquia Creek and Fredericksburg, the railroad will be constructed in 1839; between Weldon and Wilmington, (N. C.) there are now only 103 miles of railroad in operation; the remainder of the distance is under construction, and will likely be completed in 1839.

On this line of 1203 miles in length, therefore, 853 miles are traveled upon railroads, and 350 miles in steamboats. The whole distance is performed in five days, or 120 hours, or at an average ten miles per hour.—This includes all stoppages for meals, and besides, ten hours in New York. As soon as the above mentioned two sections of railroads are completed, the passage may be performed in 100 hours. or 12 miles per hour, including stoppages. This is a considerable speed for such a long voyage, on which five nights are spent, and if the railroads did not belong to thirteen different companies, whereby much time is wasted in passing the baggage from one train to another, a speed of fifteen miles per hour, including stoppages, could be attained.

The Americans, however, are not satisfied with the above railroad and steamboat connection of 1203 miles, and are establishing an opposition line between Stonington and Weldon, consisting of the following parts:

From.	To.	Communication.	Distance	Weight of rails. per yard.	No. locomotives.	Cost of Railroad.	
						Total.	Per mile.
			Miles.			Dollars.	Dollars.
Stonington	Greenport	steamboat	25				
Greenport	New York	railroad	94	21 lbs.	10	2,033,850	21,636
New York	Amboy	steamboat	25				
Amboy	Philadelphia	railroad	61	41 "	12	2,101,500	34,450
Philadelphia	Elkton	do.	44			885,712	19,675
Elkton	Somersetcove	do.	118	9½ "	8	1,024,378	8,681
Somersetcove	Portsmouth	steamboat	85				
Portsmouth	Weldon	railroad	78	9½ "	7	850,000	10,897

The railroad from Greenport to New York is not yet completed, therefore the steamboats now go direct to New York; the railroad from Elkton to Somersetcove is also yet under construction.

If this line be compared with the above described between Stonington and Weldon, it appears that the first consists in 383½ miles of railroads and 198 miles of steam navigation, and the second in 395 miles of railroads and 135 miles of steam navigation.

The above described line of railroad and steamboat communication of 1283 miles in length, is now being continued at both ends. From Boston to Portland, in Maine, a railroad of 100 miles in length is under construction, and will be completed in the course of two years. From Greensboro' to Montgomery, in Alabama, 210 miles, a railroad is also under construction and may be completed in the course of three years. From Montgomery, steamboats go upon the Alabama river to Mobile, and others from there to New Orleans. In the course of three years, therefore, the journey from Portland to New Orleans will be made in eight days, while six years ago the journey by land took forty days. The steam navigation along the sea coast has been nearly given up, in consequence of the dangerous navigation round the Capes. New Orleans is situated 13⅔ degrees south, and 19⅔ degrees west, of Portland, and the distance in a straight line is over 1400 miles. The whole line of communication will consist of 1195 miles of railroads and 884 miles of steam navigation, making together 2080 miles, which is certainly the most gigantic internal communication of this kind in the whole world, and will remain so for a long time to come.

Length and Cost of Construction of all Railroads now in operation in the United States.

In the above described two lines of communication, the one from Boston to Greensboro', Georgia, and the other between Stonington and Weldon, are nineteen different railroads, constructed by as many different corporations. The total length of these railroads is 1,191 miles, and their cost 24,252,325 dollars; the cost per mile varies according to the evenness of the surface, the weight of the iron rails or bars, and the number of locomotive, cars, &c. used upon them. It is evident that the average cost of these railroads per mile, cannot be taken as a standard, from which to calculate the cost of new railroads in America or other countries; this average, which amounts here to 20,363 dollars, will serve however, to show what the Americans have already expended for railroads.

As the American Union is formed by twenty-six different independent States, I have, as yet, not been able to compose an accurate list of all the railroads now in operation in the United States. Having, however, within the last five months, traveled over more than 2,000 miles of railroads, and obtained information in regard to most of the others, I am enabled to state, with sufficient accuracy, the total length of all the railroads in operation: this length is 3.000 miles, and taking the average cost per mile, at 20,000 dollars, the total cost of their construction has been sixty millions of dollars. The railroads have been constructed by about 100 companies and several of the State Governments. The number of locomotive engines in use is 425, equal to one engine for seven miles of road.

Length of Railroads to be opened in the year 1839.

Some of the railroads now in operation will be continued, and others now

in progress of construction will be opened in part. The length of railroads which may be expected to be completed up to the end of 1839, I estimate at 1,100 miles. This length of railroads, completed by the Americans in one year, is equal to the distance from St. Petersburg through Moscow to Odessa, and far greater than the distance from the Russian frontier, near Memel, through Berlin and Leipzick, to the frontier of Holland, on the Rhine.

The capital, which at the end of 1839, will be expended for railroads, to the extent of 4,100 miles, will, at the rate of 20,000 dollars per mile, amount to 82,000,000 dollars. If to this be added, only 8,000,000 dollars for those railroads already in progress, but not in operation, at the end of 1839, we obtain, as the total sum expended for railroads alone, ninety millions of dollars. The construction of the American railroads may be regarded as having commenced only in 1830; the above large sum has, therefore, notwithstanding the commercial crisis of 1837 and 1838, been expended almost entirely within the last ten years, by a young country, the population of which was at the last census, in 1830, only 12,860,680, and will amount at present, to not more than sixteen millions. It is a known fact, that the extent of all railroads in the world, America excepted, is only 1,600 miles; the Americans may therefore justly be regarded as the only nation which perfectly understands that railroads are nothing else than "*very good roads*," and that by their introduction alone, the two greatest internal enemies of an extensive state, "space and time," can be vanquished with success.

Letter IV.

Augusta, Georgia, April 15, 1839.

Transportation of Passengers and Freight upon the American Railroads.

The passage money upon the line of railroads and steam navigation, described in my last letter, between Boston and Greensboro', amounts to sixty-six and one-fourth dollars for the distance of 1203 miles. After the completion of the two sections, upon which stages are now running, the price will be reduced to sixty dollars. This gives, at an average, five cents per mile. Upon the stage roads in America, the average fare per mile is six and one-fourth cents, and the speed is only four miles per hour, including stoppages. Upon the railroads, therefore, one-fifth of the cost and two-thirds of the time required on common roads, are saved.

The *freight* upon the American railroads consists in manufactured articles, in drugs, cotton, tobacco, and rice, in flour and grain, in coal, lumber, wood, hay, and other agricultural products. The charges for the transportation of merchandize is seven and one-half cents per ton of 2000 lbs., per mile. Heavy and cheap articles are transported at a lower rate.

Number of Passengers and Tonnage.

The American railroads are, as already mentioned, thoroughfares between the several States, and are used principally for business. During the summer, the number of passengers is increased in consequence of many families making pleasure tours, or visiting water places, &c. &c.; but on the whole, the difference between the number of passengers in summer and winter is less here than in Europe. The Americans are an active, enterprising people, and know how to appreciate the value of time, and as the

population, compared with the extent of the country, is so much smaller than in Europe, it is evident, *that the number of passengers on the American railroads must be much less than upon those in Europe.* According to the information I received of the operations of a great number of railroads, the average number of passengers, reduced to the whole length of the roads, is only 35,000 annually.

The transportation of merchandize and produce is carried on to a great extent along the sea-coast, or upon the great Lakes; much more, however, upon the large navigable rivers, with which Providence has so much blessed this country. I have already mentioned in my second letter, that there are now 800 steamboats employed in America, and I have only to add, that most of them are used upon the rivers, for the reason that along the sea-coast passengers prefer railroads to steamboats. The connection of the rivers is effected by canals, the extent of which was already, three years ago, according to the then published reports, 3300 miles, and has been considerably increased since that time. Upon these canals there is generally a very great traffic, and only a small portion of freight is left for railroad transportation. According to ascertained facts, there are now, annually, transported over the American railroads about 15,000 tons of freight.

I have to remark here, that these numbers represent the *present traffic* upon the railroads. But, like every other thing in America, this traffic is constantly increasing. There are railroads, on which the traffic and revenue increase 25 per cent. annually, and I believe I do not err, in calculating the *annual average increase* at ten per cent.

Gross Income, Current Expenses and Interest on the Capital of Construction.

According to the foregoing results, the annual gross income, per mile of road in America, is—

From 35,000 passengers at 5 cents. . .	$1,750
" 15,000 tons of freight at $7\frac{1}{2}$ cents, . .	1,125
" transportation of mail, and incidentals, .	200
Total	$3,075

If this amount be compared with the average cost of the roads per mile, viz: 20,363 dollars, we see, that the yearly gross income is 15 per cent. on the capital invested.

The current expenses on the American railroads are proportionally small. If the total expenses of every kind be divided according to the number of passengers and tons of goods, conveyed over the road, the following average result is obtained on those railroads of which I received the accounts:

The transportation of a passenger one mile, costs $2\frac{1}{2}$ cents, therefore, of 3,500 passengers,	$875
The transportation of one ton of goods one mile, costs $6\frac{1}{2}$ cents, therefore of 15,000 tons,	975
The expenses accruing from the transportation of the mail, and incidentals, may be estimated at one half the income from these services,	100
Total	$1,950

These expenses deducted from the gross receipts of 3,075 dollars, leave 1,125 dollars as the yearly net proceeds per mile of railroad, which compared with the cost of one mile of road, 20,363 dollars, shows an annual interest of $5\frac{1}{2}$ per cent. on the capital invested.

I remark here, that this is only an average result on *those railroads which I have already inspected*, and of which some yield 10 per cent. while others yield no dividend at all; my further inspection of the several railroads here will perhaps occasion some, although, I believe, only slight alterations in these numbers.

A profit of $5\frac{1}{2}$ per cent. would be far too little inducement for the Americans, who know so well how to invest their capital profitably; but most of the railroads here were undertaken by the owners of property, and merchants in the vicinity of the line; these, of course, take into consideration the profit arising to them by the increased facility of internal communication, and calculate, that as the intercourse is constantly growing, the profits from the road must necessarily also, from year to year, increase. Some of the railroads in the Southern and Western States were constructed at the expense of the government, and a large share of the capital was attained by loans negotiated principally in England. These are the reasons why so many railroads have already been constructed in America, and still more will be undertaken in years to come, until the immense surface of country, occupied by the United States, is covered with a net of railroads, by which all the principal points will be connected.

Causes of the Cheap Construction of American Railroads.

In my last letter I stated the cost of nineteen railroads, which varies from 8,500 dollars to 56,500 dollars per mile, but amounts at an average to 20,-363 dollars; this sum comprises the expenses for the right of way, the construction of the road and buildings, the purchase of locomotive engines and cars, and engineering. Labour is much dearer in America than in Europe—a common workman gets here one dollar, a carpenter two dollars, a mason two and a half dollars, daily wages. Timber is at an average dearer here than on the Continent of Europe; the railroad iron is procured from England and imported free of duty, but for locomotive engines, wheels, axles, &c., the duty is 20 per cent. on their value. On the whole, it may be asserted that prices, so far as regards public works, are here twice as high as in Germany and Russia. In what then consists the secret of the cheap construction of American railroads? The solution of this question, together with the enquiry into the management of the American railroads, having been one of the objects which led me to this country, I believe I am able, after a careful examination during five months, to give the following satisfactory explanation of the matter:

1. The American railroads have frequently grades of thirty feet per mile, (or a rise of one in 176) and curves of 2000 feet radius, and they are nearly all undulating; a great part of the earth-work (excavations and embankments) and high bridges are thereby avoided. Inclined planes have been nearly abandoned, and tunnels are very seldom resorted to. If a high ridge is to be surmounted, grades rising to ninety feet per mile are adopted. On the railroad from Baltimore to York, a grade of eighty-three and a half feet per mile (or one in sixty-three) has been adopted for a distance of two miles; this grade is ascended by locomotives drawing four eight-wheeled cars, loaded with seven tons or 14,000 pounds each. On the Greensville and Roanoke Railroad is a rise of ninety-three and a half feet per mile (or one in fifty-six) on a distance of 9,100 feet, which is also daily ascended by locomotive engines. Where it is necessary, curves of as short a radius

as 600 feet are adopted, and no difficulty is experienced in using upon them the engines and cars of American construction.

2. Labour being very high in America, the use of machinery is more frequently resorted to. On the Utica and Syracuse Railroad, for instance, I saw in operation a steam pile-driving machine, by which the piles were lifted, a pair of them driven in at once, and then cut off at the suitable height; seven men were necessary for the management of the machine, and fifty-five piles were driven in a day to the necessary depth. On the railroad from Worcester to Springfield, now in progress, a steam excavating machine is employed, which excavates the earth and puts it upon railroad cars, while the machine moves itself forward. The work done by this machine is the excavation of 16,000 cubic feet of earth per day. Many other contrivances are frequently met with, which the space of this letter would not allow me to describe.

3. The United States are intersected by many and large rivers, and therefore a greater number of bridges are required on the American railroads than on the European. American genius has found a remedy also here. Bridges are constructed on a quite new and very cheap plan. On the railroad from Richmond to Petersburg, in Virginia, for example, a bridge was built over the James river, 2,859 feet in length, resting upon two stone abutments and eighteen stone piers; the greatest distance from centre to centre of piers is 160 feet, the superstructure is of wood and made of planks, twelve inches wide and three inches thick. The floor of the bridge it sixty feet above the surface of the water, and the whole structure cost 115,000 dollars.—The construction of this bridge was commenced in December, 1836, and it was opened on the 5th day of September, 1838. Bridges of this size are numerous in America, and are executed at an expense, which, compared with the price of materials and labour, must be regarded as very small.

4. The superstructure of the railroads in America is made conformable to the expected traffic, and costs therefore more or less accordingly. In the statement I gave in my third letter, some railroads appear with iron rails of 58 lbs. per yard, and others of only 9½ lbs. Many companies had not the means to purchase heavy rails; they therefore, at first, employed weak bars, and changed them afterwards for stronger ones, when the traffic on the road had increased. Upon the railroads with weak bars lighter engines are generally used.

5. The buildings on the American railroads are made strictly conformable to their necessities, and constructed with the greatest economy. The number of locomotive engines, of passenger and freight cars, is also much smaller here than on most of the European railroads with an equal traffic. Like the people themselves, the engines here are seen constantly in motion, and they seldom keep a reserve.

Considering the whole, it appears that the cheapness of tne American railroads has its foundation in the practical sense which predominates in their construction. If it is true, that the country is generally more favourable *here* for the location of railroads than in Germany, the cheapness of labour *there* would enable them to make railroads in Germany as cheap as here, if they were only influenced by the same practical spirit. In Russia, where the country is far more favourable, there can be no doubt, that long railroad lines, upon which no very great traffic is to be expected, may be established at the cost of from 16,000 to 20,000 dollars per mile, or from 12,000 to 15,000 silver rubles per werst.

Causes of the cheap Management of American Railroads.

The American railroads with the small traffic upon them, would doubtless not yield any profit whatever, if managed on the European costly style; it is therefore important to know also the causes of the small expenditure in their management. They are the following:

1. The *administration of all railroads* in America, without exception, is very different from, and simpler than, that in Europe. The board of directors of the company has unlimited power, fixes at its discretion the yearly dividends, and consults the stockholders only when the charter has to be amended, and applications for it are to be made to the legislature. There occurs, therefore, no intervention from the part of the stockholders, neither in their general meetings, nor at any other time; but the stockholders elect annually new directors; the latter have besides to make a yearly report to the stockholders, which is generally printed, and they are therefore subject to public opinion, which always expresses itself without reserve. The directors transfer generally the special direction of the work to an able individual, who, in such case, has the entire control over it. Their agent receives a salary of from 2,000 to 5,000 dollars per year, according to the magnitude and revenue of the work. Besides him is appointed a treasurer with a salary of 1,000 to 1,500 dollars, and sometimes also a clerk, with a salary of some hundred dollars. These individuals do, with their intelligence and activity, pretty near the same work, for which, in Europe, three times as many persons are generally employed. The same principle is followed with all other individuals necessary for the management of the road, they are all very well paid, but perform also much in proportion. It must, indeed, strike every foreigner, who passes over an American railroad, to see almost nobody on the line, so few persons at the stations, and nevertheless so much order and punctuality in the whole management.

2. The *speed upon most of the railroads* in America seldom exceeds fifteen miles per hour with passengers, and eight to twelve miles with merchandize. There are railroads upon which the passenger trains travel with a speed of twenty-five miles per hour, but these are exceptions. On the other hand the railroads pass through, or go to the centre of the cities and towns, by which the loss of time often occasioned in using omnibuses at the terminus of a road, is avoided. By diminishing the speed upon the railroads there is produced a very considerable, as yet not enough appreciated, reduction in the expenses of repairs of the road itself, the locomotives, and the cars. At a speed of from twenty-five to thirty miles per hour, engines and cars are, with the small width of track here, (usually of four feet eight and a half inches,) injured by every imperfection in the road, and they in turn destroy the track. This is the reason why the speed of fifteen miles per hour is seldom exceeded here, and the consequence of it is, that the total expenses of maintenance of way, comprising supervision, labour, and materials, are at an average only of 500 dollars per mile, annually, equal to the wages of one workman, with 200 dollars for materials.

3. The *locomotive engines* are constructed on a better plan here, than in England. The engine rests behind upon a pair of driving-wheels, and in front, upon a movable four-wheeled truck, which conforms easily to the curvature and unevenness of the road. Such an engine may therefore be regarded as a four-wheeled one, with one of the axles movable, while it actually rests upon six wheels, and therefore has all the advantages of a six-wheeled locomotive. Some of the locomotives have an outside connexion instead of a crank axle; and in constructing the engines, regard is generally

had to the grades and curvatures of the road, and whether they are to be used for passengers or freight. The weight of the engines is proportionate to the strength of the iron rails or bars, employed on the road. They have also commenced here to make eight-wheeled tenders, which can carry enough fuel and water to serve for a distance of forty to sixty miles, without it being necessary to stop the train. The pressure of the wheels upon the rails is less with these than with the four-wheeled tender, and they have at the same time the advantage of keeping better upon the track, and will not follow the engine when it leaves the rails. It will appear from these facts, that the locomotive and tender, which are so destructive to the road when constructed on the English plan, have here a much easier motion, and conform better to the curves and inequalities of the track.

4. The same qualities are found in the American *eight-wheeled passenger and freight cars*. Their advantages are so evident, that the four-wheeled cars are fast disappearing from the roads, and eight-wheeled cars substituting for them. These cars rest upon two trucks and have a very easy motion, even when the road is uneven, and not in the best order. It seldom occurs, that an eight-wheeled car leaves the track, which the four-wheeled cars are so apt to do, especially in sharp curves. When two trains happen to meet each other upon the same track, these cars are of course materially injured by the violent concussion, but almost never thrown off the track, broken to pieces, and passengers killed. It is owing to the eight-wheeled cars, that upon railroads with plate rails of two to two and a half inches in width and one-half to three-quarter inch in thickness, passengers may be carried at a speed of fifteen miles and more per hour, without feeling any unpleasant motion. The wear and tear of the track, as well as the cars, are thereby materially lessened, and the expenses for repairs of cars are, like those of locomotives, much less here than in Europe. As these repairs constitute a great item in the expenditures incident to the management of a railroad, it must be of great advantage to introduce the American cars and locomotives upon the European railroads. The price of an eight-wheeled passenger car, with fifty seats, varies from 1,800 to 2,400 dollars, according to the elegance and internal arrangements. An eight-wheeled freight car costs about 750 dollars.

The cost of a whole train, consisting of a snow apparatus, a locomotive engine with tender, and the necessary duplicates in four eight-wheeled passenger cars, and one four-wheeled freight or baggage car, is from 16,000 to 20,000 dollars, according to the size and weight of the engine, and the finish of the cars. In my opinion it would be of great advantage for every railroad company in Europe, to procure here at least, *one* such train; those companies however, whose works are yet under construction, I can advise with the fullest conviction, to procure all their locomotive engines and tenders from America, and construct their cars after the American model.

5. As *fuel* for locomotive engines, coal is seldom used in America. In Europe, the use of wood, as the cheaper fuel, has been tried, but abandoned again in consequence of the sparks coming out through the chimney and injuring and annoying the passengers. The same trials were made here, and a number of spark-catchers invented, some of which are found to answer their purpose so well, that, with some little attention only, wood can be employed as fuel; the latter is here, as in Europe, much cheaper than coal or coke.

6. A considerable reduction of expenditure in the management of Ameri-

can railroads results from the circumstance, that they are established so as to be adapted to the wants of the country. I have already mentioned the fact, that railroads are passed through populous streets of the largest cities, as of New York, Philadelphia, Baltimore, etc.; on the outskirts of these cities, the locomotive is separated from the train, and horses are attached; of which four generally draw an eight-wheeled car. Along the tracks in the streets stand the large warehouses, and side tracks, often from twenty to thirty in one street, lead into them. These sidings branch off the main track with curvatures of fifty to sixty feet radius, and by a peculiar construction, the cars are prevented from running off the track. By this arrangement the forwarding merchant receives his goods delivered into the very house, upon the railroad cars; passengers depart upon the railroads from the centre of the cities, and arrive in the same manner. The waste of time, the expensive transhipment of the goods, and the omnibuses for passengers, are thereby avoided, and the expenses incident to the management of the roads greatly reduced. The turning platforms, which in England are generally made of iron, are here made of wood, and large enough for engine and tender to be turned at once, by one or two men —their cost is at the same time much less. Many other arrangements are found on the American railroads, which facilitate the operations and reduce the current expenses.

The above exposition shows that it is entirely in the power of the railroad companies in Europe to reduce the expenses on their railroads in the same manner as they do in America.

Railroads with Flat Bars upon continuous Wooden Bearings.

From my third letter it may be inferred, that on a great part of the American railroads, plate rails from two to two and a half inches in width, and one-half to three-quarter inches in thickness, spiked on wood, are employed. The use of these flat bars, instead of heavy iron rails, contributes much to diminish the cost of construction of the American railroads, but in Europe, the opinion prevails, that these roads are subject to very heavy repairs, and are entirely destroyed after a few years, if locomotives are used upon them. As long as English locomotives, with fixed parallel axles, and four-wheeled cars, were used in America, a constant destruction of the road, and consequently of the locomotives and cars, actually took place; but the results have become quite different since the introduction upon these roads of eight-wheeled cars and six-wheeled locomotives, as formerly described. It is a remarkable fact, proved by the experience of several years, that the management of a railroad with plate rails of two and a half by five-eighth inches, and wooden superstructure, is not more expensive than the management of a railroad with massive bars, of from forty to fifty pounds per yard, provided that the speed upon the plate railroads be only twelve to fifteen miles, and upon the others twenty to twenty-five miles per hour. The increased speed upon the heavy rails so much augments the repairs of locomotives and cars, that the expenses of the latter counterbalance the great cost of maintenance and renewal of the plate rails. I came to this conclusion from extracts made from the accounts of several railroad companies, and am of opinion that well constructed and carefully managed railroads with flat bars, would in many cases answer every purpose in Germany and Russia. Should however the traffic of a railroad be so great, that trains have to pass over it every hour, I would by all means

advise to use heavy rails; not because the expenses of management would thereby be reduced, but principally, because no sufficient time is allowed to make the necessary repairs.

TO BE CONTINUED.

Railroads in the United States. By L. Klein, *Civil Engineer.*

(Continued from page 230.)

No. III.

Railroads in New Jersey, Delaware, and Maryland.

The railroads in New Jersey were constructed by private individuals without any assistance on the part of the State; the most prominent of them is the Camden and Amboy Railroad, which is the longest and has been constructed at a great expense. Nearly parallel with the same, and at a small distance only, runs another railroad, and both serve to connect the two largest and most important cities of the United States—New York and Philadelphia. The railroads in this State have all a single track, the width of which is four feet ten inches. They are used for the transportation of both passengers and freight.

There is only one railroad in the State of Delaware, connecting the Delaware river with the Chesapeake Bay. It has a double track, and was commenced as early as 1830. A part of the Philadelphia, Wilmington, and Baltimore Railroad, also passes through this State.

In the State of Maryland a great deal has been accomplished in regard to railroads. In 1828 one of the most stupendous works in the Union—the Baltimore and Ohio Railroad—was commenced; other railroads of great importance have been undertaken, and are for the greatest part finished.—The State Government has contributed much to promote the introduction of railroads, by granting loans or taking stock to a very large amount; and the city of Baltimore, aware of the incalculable advantages it must derive from being the centre of so many improvements, has liberally contributed its share to the same object. Nearly all the railroads in this State are of a very permanent construction, with a heavy T rail, and the superstructure resting upon a solid foundation; but owing to the nature of the country through which they pass, very heavy grades had frequently to be adopted. The grading is done for a double track, but only a single track is laid down. The width is four feet eight and a half inches.

Railroads completed or in progress in the States of New Jersey, Delaware, and Maryland.

No.	Name of Railroad.	From and to where.	Opened. Year.	Opened. Miles.	No. miles. besides graded.	No. miles. Not yet constr'd	Total length of road.	Dimensions or weight of iron bars or rails.	Motive power employed.	Amount of capital expended.	Amount required for completion.	Total cost of railroad	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars
1	New Jersey . .	Jersey City to N. Brunswick	1836	34			34	T rail 37 lbs.	9 locomt.	1.800.000	50.000	1.850.000	54.412
2	Paterson and Hudson	New Jersey R. R. to Paterson	1834	14			14	plate $2\frac{1}{2}\times\frac{5}{8}$	4 locomt.				
3	Morris and Essex .	Newark to Morristown .	1837	23			23	do. $2\frac{1}{4}\times\frac{5}{8}$	3 locomt.	327.000		327.000	14.200
4	Elizabethtown and Somerville . .	Elizabethtown to Somerville	1840	22		4	26	do. $2\frac{1}{2}\times\frac{5}{8}$	2 locomt.	300.000	50.000	350.000	13.462
5	Camden and Amboy	Camden to Perth Amboy	1835	61			61	T rail 38 lbs.					
6	Camden and Amboy Branch . .	Bordentown to Trenton and New Brunswick .	1839	31			30	do. 48 lbs.	17 do.	2.700.000		2.700.000	29.348
7	Camden and Woodbury	Camden to Woodbury .	1833	7			7		2 locomt.				
1	Newcastle & Frenchtown	Newcastle to Frenchtown	1832	16			16	do. 40 lbs.	6 locomt.	400.000		400.000	25.000
1	Wilmington and Susquehanna . .	Wilmington to Havre deGrace	1837	34			34	do. 42 lbs.					
2	Baltimore and Port Deposit . .	Havre de Grace to Baltimore	1837	36			36	plate $2\frac{1}{2}\times1\frac{3}{4}$	10 do.	3.430.000		3.430.000	49.000
3	Baltimore and Ohio .	Baltimore to Pittsburg and Wheeling . .	1831	85	25	325	435	T rail 52 lbs.	16 locomt	4.000.000	9.000.000	13.000.000	30.000
4	Washington Branch	B. & O. R. R. to Washington	1835	$30\frac{1}{2}$			$30\frac{1}{2}$	do. 40 lbs.	4 locomt.	1.660.000		1.660.000	54.426
5	Baltimore and Susquehanna . .	Baltimore to York .	1838	58			58	do. 58 lbs.	12 locomt				
6	Westminster Branch	Baltimore and Susq. R. R. to Westminster . .	1832	10		8	18	plate $2\frac{1}{4}\times\frac{1}{2}$	horses.	2.800.000	200.000	3.000.000	44.118
7	Baltimore and Annapolis	Elkridge to Annapolis .	1840	$19\frac{3}{4}$			$19\frac{3}{4}$		2 locomt.				
8	Eastern Shore .	Elktown to Somersetcove			20	98	118			112.500	1.400.000	1.512.500	12.818
16				$480\frac{3}{4}$	45	435	$961\frac{1}{4}$		87 locomt				

Remarks.—Of the Paterson and Hudson, and Camden and Woodbury, Railroads, the cost of construction has not been ascertained, as also of the Elkridge and Annapolis Railroad.

The Wilmington and Susquehanna, and Baltimore and Port Deposit, Railroads, form with the Philadelphia and Wilmington Railroad (see State of Pennsylvania) only *one* line, denominated the Philadelphia, Wilmington, and Baltimore Railroad; the total cost of the whole is, 3,930,000 dollars, and the number of locomotives, 14.

In the following summary statement of the railroads in the States of New Jersey, Delaware, and Maryland, the cost of the Paterson and Hudson, Camden and Woodbury, and Elkridge and Annapolis, Railroads, has only been *estimated;* their length being inconsiderable compared with the total length of all the roads; the general results cannot be much influenced, should the estimate be a little too high or too low.

Name of State.	Number of Railroads.	No. miles in operation.	Total length of railroads.	Number of locomotives.	Amount of capital expended.	Amount required for completion.	Total cost of railroads.	Average cost per mile.
			miles		dollars.	dollars.	dollars.	dollars.
New Jersey,	7	192	196	37	5,547,000	100,000	5,647,000	28,826
Delaware,	1	16	16	6	400,000		400,000	25,000
Maryland,	8	273¼	749¼	44	12,400,000	10,600,000	23,000,000	30,700
	16	481¼	961¼	87	18,347,000	10,700,000	29,047,000	30,218

According to the above statement, there are now sixteen railroads in these three Atlantic States, with an aggregate length of 961¼ miles, of which 481¼ miles are already in operation, or nearly one half of the whole length. The number of locomotives employed upon 471¼ miles of railroads is eighty-seven, being at the rate of one engine for every 5.4 miles of road.

The sum of 18,347,000 dollars has already been expended, and 10,700,000 dollars more will be required to put in operation the still unfinished parts of several lines; of the 961¼ miles of railroads the average cost per mile will then be 30,000 dollars.

No. IV.

Railroads in the Eastern States.

The railroads in the New England States, principally those in the State of Massachusetts, are not only among the most solid and best constructed, but at the same time the most prosperous and profitable in the United States. They were all constructed by private companies, to several of which loans were granted on the part of the States. The oldest railroad not only in these, but in the whole United States, is the Quincy railroad, near Boston, completed in 1827. The longest will be the Western Railroad, extending from Worcester to West Stockbridge, a distance of 117 miles; Nearly all the railroads in the Eastern States have been graded for a double track, but with the exception of the Boston and Lowell Railroad, only a single track has been laid down. The superstructure consists mostly of wooden cross ties upon mud sills, supporting a heavy iron rail of from forty to fifty lbs. per yard. The width of track is uniformly four feet eight and a half inches.

Railroads completed and in progress in the Eastern States.

No.	Name of Railroad.	From and to where.	Opened. Year.	Opened. Miles.	No. miles. Besides graded.	No. miles. Not yet constr'd	Total length of road.	Dimensions or weight of iron bars or rails.	Motive power employed	Amount of capital expended.	Amount required for completion	Total cost of railroad.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Bangor and Orono .	Bangor to Orono . .	1836	10			10		2 locomt.				
2	Nashua and Lowell .	Nashua to Lowell . .	1838	$14\frac{1}{4}$			$14\frac{1}{4}$	T rail 57 lbs.	3 locomt.	354.000		354.000	24.842
3	Boston and Lowell .	Boston to Lowell . .	1835	26			26	do. 46 lbs.	7 locomt.	1.610.000	190.000	1.800.000	79.231
4	Charlestown Branch .	Boston and Lowell Railroad to Charlestown . .	1839	$1\frac{1}{3}$			$1\frac{1}{3}$	do. 45 lbs.		91.028		91.028	68.271
5	Boston and Portland	Boston and Lowell Railroad to Exeter . . .	1839	$34\frac{3}{4}$			$34\frac{3}{4}$	do. 45 lbs.	4 locomt.	610.000	90.000	700.000	20.144
6	Quincy . . .	Quincy Quarries to Neponset River	1827	4			4	plate.	horses.				
7	Eastern (in Mass.) .	Boston to State Line of N.H.	1839	25	$12\frac{1}{2}$		$37\frac{1}{2}$	T rail 45 lbs.	8 locomt.	1.306.196	193.804	1.500.000	40.000
8	Eastern (in N. H.) .	Portsmouth to State Line of Mass.			10	5	15					600.000	40.000
9	Marblehead Branch .	Eastern R. R. to Marblehead	1839	3			3	do. 45 lbs.					
10	Boston and Worcester	Boston to Worcester .	1835	$44\frac{1}{2}$			$44\frac{1}{2}$	do. 40 lbs.	10 locomt.	1.848.085		1.848.085	40.000
11	Millbury Branch . .	Boston and Worcester R. R. to Millbury . . .		$3\frac{1}{4}$			$3\frac{1}{4}$	do. 40 lbs.	horses.				
12	Western . . .	Worcester to West Stockbridge	1839	$54\frac{1}{2}$	33	$29\frac{1}{2}$	117	do. $55\frac{1}{2}$ lbs	8 locomt.	2.800.000	1.700.000	4.500.000	38.462
13	Boston and Providence	Boston to Providence .	1835	42			42	do. 58 lbs.	11 locomt.	1.850.000		1.850.000	44.048
14	Dedham Branch .	Bost. & Prov. R.R. to Dedham		3			3	plate $2\frac{1}{4} \times \frac{5}{8}$	horses.				
15	Taunton Branch .	Bost.& Prov. R.R. to Taunton	1836	11			11		2 locomt.	250.000		250.000	22.727
16	N. Bedford and Taunton	Taunton to New Bedford .			10	10	20	T rail 58 lbs.		151.039			
17	New York, Providence, and Boston . .	Providence to Stonington .	1837	$47\frac{1}{2}$			$47\frac{1}{2}$	do. 58 lbs.	6 locomt.	2.500.000		2.500.000	52.632
18	Norwich and Worcester	Norwich to Worcester .	1839	59			59	do. 56 lbs.	4 locomt.	1.360.000	140.000	1.500.000	25.424
19	Hartford and N. Haven	New Haven to Hartford. .	1838	18	10	10	38		2 locomt.			760.000	20.000
20	Housatonic . .	Bridgeport to State Line .	1839	35		38	73		2 locomt.			1.095.000	15.000
20				436	$75\frac{1}{2}$	$92\frac{1}{2}$	604		69 locomt.				

With the exception of a few short branches, locomotive steam power is used upon all the railroads for the transportation of passengers and goods. The income, which is derived principally from the conveyance of passengers, is on most of these roads very considerable, and will average fifteen per cent. annually, on the cost of construction, although the latter is higher here than of the railroads in other States.

By an existing law, the railroad corporations in the State of Massachusetts have to make annual reports of the operations of their roads to the Legislature. Much information may be derived from these reports, which would, however, be still more useful by containing more detailed data, principally in regard to the expenditures on the lines.

The foregoing statement is prepared from information attained mostly in the winter of 1839, and is therefore not complete; corrections were made from the reports, so as to show the progress of the works up to the end of 1839.

Remarks.—Of the Nashua and Lowell Railroad nine miles are in Massachusetts, and five and a quarter in New Hampshire. Of the Boston and Portsmouth, twenty-five and three-fourths miles are in Massachusetts, and nine in New Hampshire. The Providence and Stonington Railroad is nearly entirely in Rhode Island. Of the Norwich and Worcester Railroad eighteen miles are in Massachusetts, the remainder in Connecticut.

In giving a summary statement of the railroads in each of the states of New England, the cost of construction of those which are located in two states has been divided in proportion to the length of the line in each of them, as there are no data for a more correct repartition.

Name of State.	Number of Railroads.	Number of miles in operation.	Total length of Railroads.	Number of Locomotives	Amount of capital expended.	Amount required for completion.	Total cost of Railroads.	Average cost per mile.
Maine,	1	10	10	2	200,000		200,000	20,000
New Hampshire,	1	14¼	29¼	2	610,000	300,000	910,000	31,111
Massachusetts,	14	270¼	365¼	52	11,100,000	2,435,000	13,535,000	37,055
Rhode Island,	1	47½	47½	6	2,500,000		2,500,000	52,632
Connecticut,	3	94	152	7	1,905,000	1,000,000	2,905,000	19,079
	20	436	604	69	16,315,000	3,735,000	20,050,000	33,195

There are in the whole 20 Railroads in the Eastern States, with an aggregate length of 604 miles; of these, 436 miles were in operation at the end of 1839, and the other 168 miles were in progress. Sixty nine locomotive engines are employed upon 436 miles of roads, or at an average of one engine upon $6\frac{1}{6}$ miles.

The total amount of capital already expended for Railroads in New England is $16,315,000, of which $11,100.000 were expended in Massachusetts alone; with an additional sum of $3,735,000 all the Railroads hitherto commenced will be completed and the total expenditure will amount to $20,050,000, equal to $33,195 per mile at an average.

No. VIII.

In order to give a more general summary view of *all* the Railroads in the

different States of the Union, the following statement contains a recapitulation of the number and length of Railroads in operation and progress in each of the States, of the number of Locomotives employed thereon, the capital expended and that required to complete the works in progress, the total cost of the Railroads when completed, and the average cost per mile.

Name of State.	Number of Railroads.	Number of miles in operation.	Total length of Railroads.	Number of Locomotives	Amount of capital already expended.	Amount required for completion.	Total cost of Railroads.	Average cost per mile.
Maine,	1	10	10	2	200,000		200,000	20,000
New Hampshire,	1	14¼	29¼	2	610,000	300,000	910,000	31,111
Massachusetts,	14	270¼	365¼	52	11,100,000	2,435,000	13,535,000	37,055
Rhode Island,	1	47½	47½	6	2,500,000		2,500,000	52,632
Connecticut,	3	94	152	7	1,905,000	1,000,000	2,905,000	19,079
New York,	28	453¾	1317¾	45	11,311,800	10,503,000	21,814,800	16,570
Pennsylvania,	38	576½	850¼	114	18,070,000	5,042,000	23,112,000	27,183
New Jersey,	7	192	196	37	5,547,000	100,000	5,647,000	28,826
Delaware,	1	16	16	6	400,000		400,000	25,000
Maryland,	8	273¼	749¼	44	12,400,000	10,600,000	23,000,000	30,700
Virginia,	10	341	369	42	5,201,000	250,000	5,451,000	14,772
North Carolina,	3	247	247	11	3,163,000		3,163,000	12,806
South Carolina,	2	136	202	27	3,200,000	800,000	4,000,000	19,802
Georgia,	4	211½	640½	17	5,458,000	4,320,000	9,778,000	15,266
Florida,	4	58½	217	5	1,420,000	2,400,000	3,820,000	17,604
Alabama,	7	51	432½	3	1,222,000	3,434,000	4,656,000	10,763
Louisiana,	10	62	248¾	20	2,862,000	1,834,000	4,696,000	18,880
Mississippi,	5	50	210½	8	3,490,000	2,240,000	5,730,000	27,221
Tennessee,	3	0	160½	—	1,100,000	855,000	1,955,000	12,180
Kentucky,	2	32	96	2	947,000	1,250,000	2,197,000	22,885
Ohio,	6	39	416	1	420,140	2,859,000	3,279,000	7,883
Indiana,	2	20	246	2	1,375,000	3,425,000	4,800,000	19,512
Michigan,	10	114	738½	8	1,896,000	5,653,000	7,549,000	10,222
Illinois,	11	23	1421	2	1,832,500	15,177,500	17,010,000	11,970
Total.	181	3332½	9378½	463	97,630,440	74,477,500	172,107,940	18,351

It appears, from the above table, that at the end of 1839 *the number* of Railroads completed and in progress in twenty-four States of the Union, in which this kind of improvement has already been introduced, amounted to 181, of which 3332½ miles were opened and in use; 1707¼ miles were besides graded and ready for the superstructure, and the total length of all the lines undertaken was not less than 9378½ miles.

The number of Locomotive Engines employed upon all the Railroads in the United States, was at that time 463, (about one Locomotive for every seven miles of road.)

As accurately as could be ascertained, the total amount expended on all the works, up to the end of 1839, was $97,630,440, the amount still required to complete the works that were commenced, was $74,477,500, and the total expenditure for Railroads, when all the works in progress will be completed, will be $172,107,940. If this latter sum be divided by 9378½ (the length in miles of all the 181 Railroads) we obtain $18,351 as the average cost per mile of Railroad with a single track,* including buildings, fixtures and outfit.

* Compared with the total length of all the Railroads, the length of those with a double track is inconsiderable.

Many of the Railroads in progress will, perhaps, cost more than has been estimated for, but even if the actual cost should exceed the estimates by $15,000,000, the average cost per mile of Railroad will not be more than $20,000.

Mr. D. Stevenson in his "*Sketch of Civil Engineering in North America,*" (London, 1838,) gives a list of all the Railroads completed and in progress in 1837. According to his statement, there were at that time 1652¼ miles of Railroads in operation, and 2,760 miles in progress. The extent of Railroads put into operation since 1837, or during the last three years, is therefore 1680 miles, being at an average of 560 miles per year; it must, however, be remarked that the extent of Railroads put into operation in 1839 was less than might have been expected, owing to the difficulty of raising loans in Europe. If only half the length of lines which were graded had been completed, the number of miles in operation at the end of 1839 would have exceeded 4100, as was anticipated by the late Chevalier de Gerstner.

TO BE CONTINUED.

Physical Science.

Notices of the Weather, and Meteorological Observations made at Nashville, Tennessee. By Prof. James Hamilton.

Meterological Summary July 1840.

Mean temperature 78°.04.; max. 95°, on 17th, 18th and 29th., min. 60°, on 3d; range 35°—mean of Bar. 29.604.; max. 29.73, on 26th; min. 29.40, on 13th and 23d; range 0.33. The maximum temperature occurred before noon on the 10th, 11th, 17th, 18th, 19th, 28th, 29th, 30th, 31st days. There were several showers between the 7th and 24th days, and those of the 8th, 9th, 22d and 23d were quite heavy. Rain fell on 10 days—amount of rain 5.05 inches. Of 93 observations on the state of the sky, 43 were clear, 40 cloudy and 10 rainy. Of an equal number on winds, 4 were from the N., 25 NE., 3 E., 5 SE., 48 SW. and 8 W. Warmest day the 29th, and its mean 85°.

August.

Mean temperature 77°.24., max. 96°; on the 3d, min. 55°; on the 9th, range 41°—mean of Bar. 29.590; max. 29,83; on 18th, min. 29.42; on 13th, range 0.41. In this month also, the max. temp. was during the forenoon. On the 4th, 5th, 6th, 7th, 10th, 12th, 14th, 21st, 22d, and 24th, 10 days of rain—amount 4.90 inches. Clear observations, 61—clondy 32. Winds, 5 N., 17 NE., 3 E., 4 S·E., 48 SW., and 16 West. Dews heavy after the middle of the month, and morning fogs from the 25th to the 29th inclusive—very little thunder during July and August—warmest day 3d, with a mean of 86°.

September.

Mean temp. 66°35; max. 88°, on 8th; min. 43°, on 19th; range 45°. Mean of Bar. 29.634; max. 29.86, on 13th; min. 29.42, on 20th; range 0.44. The mean temp. at noon exceeded that at 3 P. M., by two degrees. 7 rainy, 12 clear, and 11 cloudy days—amount of rain 3.04 inches. Of 90

obs. 48 clear, 36 cloudy, and 6 rainy. Winds, 10 N., 17 NE., 8 E., 2 S.E., 34 SW., 10 W. and 9 NW.

N. B. The storm noticed in the last report as occurring on the 20th of June, took place on the 21st.

Hourly Observations made at the Univerity of Nashville, Tenn., during the Autumnal Equinox, 1840.

SEPTEMBER 21.

A. M.	Ex. Thr.	At Thr.	Bar.	Weather.	Wind. Direc.	Wind. Force.	
6	52	65	29.55	clear.	NE.	1	Min. 52°. Hazy
7	54	66	.57	do.	do.	1	in the horizon all
8	57	66.8	.59	do.	do.	2	this day.
9	60	67	.59	do.	do.	2	Dew point 47°
10	63	67	.595	do.	do.	1	
11	66	67	.588	do.	do.	2	
12	68.5	67.25	.583	do.	do.	3	Dew point 47°.5
1 PM.	70.5	67.5	.580	do.	do.	2	
2	70	68	.574	do.	do.	3	
3	69.5	68	.570	do.	do.	5	Dew point 47°.5
4	69.5	68	.580	do.	do.	3	
5	68	68	.591	do.	do.	3	
6	65	68	.610	do.	NE. by E.	1	
7	62	67.5	.630	do.	do.	2	
8	59	67.25	.640	do.	do.	2	
9	58	67	.645	do.	do.	2	
10	56	66	.650	do.	do.	1	
11	54.5	66	.660	do.	do.	1	
12	52	66	.665	do.	do.	0	Dew point 56°
				SEPTEMBER 22.			
1 AM.	50	66	.670	do.	E. NE.	0	
2	48.75	65	.660	do.	do.	0	Dew point 54°
3	47.5	65	.660	do.	do.	0	
4	47	64.5	.680	do.	do.	0	
5	46	64	.687	do.	E.	0	
6	45	64	.705	do.	do.	0	
7	50	64	.710	do.	do.	0	

Franklin Institute.

Address delivered before the Franklin Institute at the close of the Eleventh Exhibition of American Manufactures, on Wednesday Evening, October 22, 1840. *By* FREDERICK FRALEY, ESQ.

Less than two centuries ago the place where we are now assembled, and the whole of the fair territory which forms the American Union, were the habitation of uncivilized man, depending upon the precarious chance of the chase, and the spontaneous bounty of Nature, for his support, and protected from the changes of the climate by the skins of the animals which his skill

in hunting enabled him to overcome. What forms the history of our nature, gradually emerging from such a rude state, is the history of the world; and while each generation has contributed something to make mankind more skilful, more wise, and more happy, it is the distinguishing characteristic of the age we live in, that the discoveries in the sciences and useful arts have been multiplied beyond all previous times; that new sources of wealth and prosperity have been opened; and that the means for making our knowledge universal, have been increased by the rapidity with which new discoveries are communicated from nation to nation, and by the general diffusion of education, enabling all to sieze upon the moving mass, and intelligently to shape and fashion it to their individual purposes. If we look back for the brief space of about ten centuries, we find that the great nations of modern times, whose ships now swarm in every sea, bearing the products of their varied industry from land to land, and by an interchange of benefits, bringing the extremities of the earth into one common brotherhood, were hampered by systems of government, which made war and conquest the great business of the people, and regarded the artisan and agriculturist as beasts of burthen; whose persons and property might be transferred from one master to another, at the will of him who wielded the most successful sword. But the stern necessity which compelled the conquering chieftain to protect his acquired territories, and to shine in the martial chronicles of the day, also called upon the artisan to fabricate new instruments of attack and defence; to provide stores of clothing and provisions, and to construct vehicles by whose means armies and their stores could be transported from place to place. The same necessity required that the husbandman should be protected in his labour, that the fields and flocks which furnished food and clothing, should be well attended to, and the wise and daring chieftains of feudal times soon discovered, that in order to place their power upon the surest foundation, it was necessary to elevate the condition of their feudatories, by giving them a direct personal interest in their own labours, and changing the precarious supplies which were reluctantly conceded to absolute power, to the more congenial plan of a fixed and permanent participation in the labour and industry of their vassals.

The stimulus of individual interest soon doubled and quadrupled the products of the soil, and the workshops, whose tenants had unwillingly forged the shield, the javelin, or the sword, or fabricated the vestment of the soldier, began to sound with the busy hum of cheerful and free industry, and amassed those treasures of labour which form the objects of commerce. These accumulations of industry gradually liberated a portion of the people from the necessity of an actual participation in the business of production, and converted them into mariners and merchants, whose adventurous spirit, carrying them beyond the narrow boundaries of their respective lands, caused an interchange of the surplus productions of each; and while the fruit of such voyages created new wants in every country, those wants were met by the steady and successive efforts of the powers with which the Creator has endowed mankind; and the results are now apparent all over the civilized world, in their improved forms of government, in the evidences which are furnished by their houses, ships, clothing, and agricultural productions, in the great chains of canals and railroads which bind together the different interests of each community, and stretch forth willing arms to connect them with adjoining States; but above all are these results to be prized, because they have led man to elevate himself above his merely animal nature, and to seek in the cultivation of his mind, the realization of

that similitude to his Maker, which the light of nature shadowed forth to the ancient heathens, but which the book of revelation has confirmed to us by the direct inspiration of his spirit. We turn to our own country, and we behold that the settlements which a few pilgrims and adventurers from Europe planted on our shores, have grown into a mighty nation, second to none in the wise and liberal spirit of its government, in the general intelligence of its citizens, and in the perfect adaptation of the soil and climate where it is located, to furnish us with every thing, which but for the sympathetic cord which connects us with the entire world, might lead us to avoid all intercourse with other countries. But, happily, the spirit which was impressed upon our institutions at their foundation, leads to no such result. The cold hearted colonial policy, which bound us with the iron fetters of dependence upon the mother country, while we were in our infancy, found no favor with us when we assumed our place among the nations of the earth; and a wise, equal, and just system of commercial regulations has, from that time up to the present, been signalized by an unexampled increase of wealth, population, and prosperity.

Until the spirit of the American revolution began to show itself in the determination of the people to avail themselves of their natural resources, and of their power to supply themselves with many things which, if manufactured at all, were done so clandestinely, the policy of England had been to prevent every thing like manufactures from being prosecuted at all among us; and the unnatural spirit which dictated such a course, had only to glory in a very restricted trade, which benefitted neither the parent state nor the colonies.

As soon, however, as we achieved our national independence, the benefits of a more liberal system became apparent; and as we added ship to ship, and manufactory to manufactory, the tide of national greatness swelled over our country, and continued to roll on until it has conducted us to the time which it is the purpose of this address to mark. We are surrounded in these halls by the most gratifying evidence of the skill of our manufacturers and mechanics, and of the capacity of our country to furnish the raw materials on which the ingenuity and talents of our citizens may be exerted. Every thing is here which necessity could crave, which comfort could desire, or which luxury and wealth are competent to command; and when we reflect in what minute channels the principle of industry must run to elaborate the delicate and costly articles of this display, and what a mighty grasp of mind must have been needed to frame the machinery and to superintend the processes which have yielded the various fabrics of cotton, wool, and iron, which crowd our stands and tables, and indicate the true state of the arts among us, as well as the extent of the products of those arts, the mind can scarcely realize the fact, that all this has been accomplished by a nation not yet numbering three-quarters of a century in age, whose population, at the same time, has been employed in clearing the forest, and winning our soil from the wilderness, in building vast cities, in opening roads and canals, and in contributing, by the immense productions of her agriculture, to the support of the commerce and manufactures of the great European nations, from whom a large portion of that population has been derived. Nor while we have thus been so actively employed in the mere fabrication of such masses of industrial productions, has the genius of our citizens slumbered, nor have we been wholly dependent upon the machinery invented by foreigners for the accomplishment of these great results. The cotton gin of Whitney, eliminating the food for the gigantic productions

of the machinery of Arkwright, Cartwright, and others, is but one triumph of genius in the series of American inventions which sometimes seized upon the idea that a foreign brother mechanic had struck it, but more frequently with native originality compassed the whole machine which has given a new direction to national industry.

The discovery of the quadrant by Godfrey; the successful application of steam to navigation, by Fulton, Rumsey, and Fitch; the untiring devotion of Evans, to multiply the uses of that potent agent, and to simplify the ponderous engines of the distinguished Watt, and the infinite number of new and useful inventions which claim the American name, all go to prove that we have contributed our full share to the mass of useful knowledge, and that our country presents a gratifying and conclusive evidence of the tendency of popular institutions, of freedom of thought and of action, to work out the highest and noblest destinies of man. While we have thus prospered as a nation; while the names of American inventors and their works are known and appreciated in foreign lands, we have also been associating together for the purpose of mutual instruction and inprovement; and Schools, Academies, Colleges, and Scientific Institutions, are to be found scattered broad cast throughout the land, ministering to that boundless thirst after knowledge which characterises us as a people. Our own State has not fallen back in this noble and generous emulation; the character which the hand of her illustrious founder impressed upon her Institutions, the wise, just, and liberal policy with which his noble mind sanctified his treaties with the aboriginal inhabitants, and his agreements with the original settlers, have all combined to render Pennsylvania the abode of Science, and to make her distinguished among her Sister States, for her encouragement of Education, for her care of the great interests of her people, and for binding that people together by the enduring facilities of intercourse among each other. The original frame of government for the province and each of the Constitutions which have since been adopted by the people, contained provisions which declare the duty of the State to watch over the education of the people, and to encourage the Arts and Sciences; and the establishment of the University of Pennsylvania, of several Colleges and Academies, the incorporation of the American Philosophical Society, the Academy of Natural Sciences, and several Associations of a kindred character at a very early day, shews that those salutary features of our fundamental law have not been neglected either by the citizens or their legislators. Connected with these early Institutions was a very imperfect system of popular instruction, and the Arts and Sciences seemed to be widely sundering from the mechanic and manufacturer, when a few energetic and philanthropic gentlemen of this city determined to establish the Franklin Institute, and to form by its means a series of continuous and appropriate links between the ordinary schools of the State, the workshops, and the higher circles of scientific pursuit. The regulations of the Institution were framed on the most comprehensive and popular basis, and the support which it has hitherto received may be relied upon as a sure index of its continued success and usefulness. By its Schools Lectures, Exhibitions, Committees on Inventions and Science and the Arts, and in its Journal, Library and various collections of Models, Minerals, Materials and Fabrics, it possesses the means of diffusing practical knowledge, of testing the value and usefulness of new discoveries, and of checking the dangerous flights of uneducated genius. It enables the Man of Science to commune on the same platform with the practical mechanic, and to blend the truths of Theory with the more rugged ways of the work-

shop, thereby enabling the philosopher to start from a higher point, and the workman to dispense with processes which he had before deemed essential to his Art. Since the successful establishment of the Institute in 1823, similar Institutions have been formed in our own State, and in several other States, and the benefits which have been realized from them are in a great measure exhibited by what we have before us now; showing the accurate knowledge of principles, the perfection of workmanship, the skill in combination, and the beauty and variety of ornament which characterize the daily productions of our looms, forges, laboratories and workshops. Nor are these tangible evidences all; we find an animated intelligence beaming in almost every eye, an awakened interest in what is passing in the varied world around us, and each man feels the necessity of understanding the principles of Science, and of learning what constitute the great discoveries of the day, to enable him to walk erect among his fellows, and to share in the high intellectual enjoyments which he perceives are at their command. To some of us who have been connected with the institution from its origin, the results which it has accomplished appear almost like the fabled creations of Aladdin's lamp. Each succeeding year has increased its members, the thirst after knowledge has remained unquenched, and its revenues have been found entirely inadequate to feed the noble flame which burned in the hearts of those who are seeking knowledge at its shrines. To meet the wishes of its members for enlarged facilities of instruction, and to extend, by a more commodious and larger building than its present Hall, the accommodations for its cabinets and meetings, the structure in which we are now assembled and its site were purchased about five years ago under promises of public support, which up to this time have not been realized; and the institution has been compelled to abandon, for the present, the project of erecting a new Hall, and must endeavor to dispose of this building without any further sacrifice of its ordinary income, which has already been deeply trenched upon in the effort to secure so desirable an object.

While, however, it has been disappointed in erecting a substantial and suitable edifice for its purposes, the vigorous zeal which has distinguished the prosecution of other labors has not flagged. The arrangements for instruction during the coming winter comprehend regular courses on Chemistry, Natural Philosophy, and Mechanics, Technology, Architecture, and Geology; with occasional discourses on other branches of knowledge. The library, already numbers several thousand volumes, and is steadily increasing, and by means of the journal a crowded reading room is kept constantly supplied with the best periodical literature of the day, with newspapers from all parts of our own country, and with every valuable journal published in Europe, devoted to the advancement of the sciences and useful arts. A drawing school under the care of one of our best teachers, is kept open during six months in every year, and while the instruction afforded in it has been placed by a moderate fee within the reach of every industrious apprentice, the additional advantage of admission to the lectures without additional charge, offers to every pupil of the school under twenty-one years of age, a course of instruction which could not be commanded elsewhere without the payment of a sum much larger than could be conveniently spared from his earnings. The arrangements for the admission of the sons, apprentices and wards of members have been framed on the same liberal basis: the sum of one dollar entitling such persons to attend all the lectures of the Institute; and ladies can also obtain the ticket of admission to the several courses by the payment of two dollars annually. A meeting for

conversation on mechanical and scientific subjects is held once in each month, with the exception of the months of July and August, a free and familiar interchange of opinion on the great discoveries of the day, and of inquiry into the different processes of art and manufactures are thereby presented in a form which can be participated in by those who would shrink from a more formal exhibition of their proficiency in the departments of science and useful industry to which they devote their time and attention. A committee on science and the arts to which every member of the Institute may voluntarily attach himself, is constantly engaged by its sub-committees in investigations pertaining to theoretical Mechanics, in examining new machines or improvements in those in general use, in testing the value of new processes, and in advising those whose genius has either in whole or in part been anticipated by others, what part of their machines or processes have been known before, what theoretical or practical difficulties impair the value of their discoveries, when they are new, and to what sources they may direct their attention and labors with advantage; and in rewarding, by the Premium and Medal established by John Scott of Edinburg, the distributions of which have been confided to the Institute by the City Corporation, such Inventions and Discoveries as may be worthy of that honorable distinction. The reports of their sub-committees are regularly brought before the Committee at its monthly meetings, and thus the whole field of practical research is kept before the eye of every one, who thinks proper to devote an hour or two periodically to the subjects which have been in this manner brought under examination. The other departments are placed in charge of appropriate Committees, and the whole forms a Polytechnic and Scientific Institution every way worthy of your liberal and enlightened patronage.

We are about to close this Exhibition of the products of our native industry, and the occasion may be improved by a brief examination of the advantages which such displays afford. Viewed in the mass, they gratify our proper National pride, and by developing the resources of our country, naturally withdraw our attention from an habitual and too general dependence on other lands which are supposed to be favoured with great facilities for production, and turn us with stronger affection and confidence to those channels of supply, which patriotism and independence have already marked upon our soil, and which a steady and generous support will widen and deepen until they become capable of furnishing every thing, which, as a people forming part of the great family of Nations, and maintaining a proper and reasonable intercourse with the rest of the world, we could desire. In their particular benefits, it may be truly said that they furnish Manufacturers and Mechanics with opportunities for comparing their own work with that furnished by others; of detecting individual defects and excellencies, of softening down mutual prejudices, and where great skill and ingenuity have been shown, to make that skill and ingenuity a sort of common property, to be availed of, either for present advantage, or to be made the basis of new improvements in the fabrics which form the subjects of the skill and industry of our citizens. Further, they are calculated to enlarge our National Commerce, by furnishing articles which neighboring nations and which different parts of our own Country less capable of manufacturing, are continually requiring, to enable them to conquer the forests, to open their soil, to clothe their inhabitants, to build and furnish their houses, and to contribute their share to the beneficent design of Providence which makes all mankind brethren, by making them in some degree dependent upon each other. While the loom, the forge and the workshop owned

by the civilized, refined and educated European or American, contribute to the natural appetite of the savage or the half civilized man for display and ornament; it must not be forgotten, that the spoils of the chase, the spontaneous productions of the earth, and the golden sands which come from the lands which own the savage and the uncivilized for their lord, are equally prized by us; and that if they value the scarlet cloth, the showy bead, or the glittering mirror, we clothe beauty and dignity with the fur of the ermine and the sable; we adorn our houses, temples and persons with the gold and precious stones and costly woods of their lands; and we fill our tables with the fruits and spices, with the luxuries and necessaries of life, which their generous soil and favorable climate yield. While the articles which form the media, by which these national exchanges are effected, are here represented, we have only to look a short distance beyond these walls for the ships, the mariners, and the merchants by whose agency they are transported to their appropriate markets. The golden fleeces of Commerce, the rich rewards of Agriculture, and the prosperity of our Manufactures, are all dependent upon each other; and if any one of these great departments of human employment be suffered to languish, decay and ultimate ruin will soon destroy them all. We read this admonitory truth in all the pages of History. Where is now the Commercial importance which made the ancient Tyre, and the more modern Venice, Queens among the cities of the earth? Where in the rank of nations stand Spain and Portugal, by whose citizens America was discovered, and the ready and successful way to the great East opened? Where, in fine, are the lands which gave birth to the liberal and useful Arts, whose Poets and Philosophers even at this day teach us the lessons of Wisdom, and the beauty and harmony of language? All, all, have been sunk either by the vices or the imbecility of their rulers, by an abandonment by their inhabitants of the true sources of National Wealth and greatness; and by the influence of that policy, which deems ourselves much wiser than our neighbors, and is contented to stand still while they are seeking to avail themselves not only of National advantages, but of the improvements which Science and Enterprise place within their control.—We of Pennsylvania must especially take these truths to heart. We have been blessed with a fertile soil, with hills and valleys teeming with mineral wealth, with a free government, with citizens who in past times have kept foremost in the ranks of the Union for their Agriculture, Commerce and Manufactures, who have clothed our roads, rivers and canals with the mantle of the Commonwealth, who have built and endowed colleges, academies, schools, asylums and other institutions, and who have placed in our hands those peaceful weapons with which the noblest and most enduring triumphs of nations are achieved. Let us see to it then, that we fall not back among the nations; let us seize upon every thing which is calculated to make us wiser, better, more skilful and more prosperous.

Let not a seeming disadvantage in the location of our metropolis, at a point a little more distant from the great highway of nations than some of our neighbors, make us forego the advantages which a new application of the discovery of our own Fulton now promises in the world; or the consciousness of what we have accomplished induce us to fold our arms in contempt of the great struggles of the nations for superiority; but with a noble and generous spirit, cherishing every institution which promotes our agriculture, which instructs our mechanics and manufacturers, which educates our merchants and mariners, make all our citizens sensible of the duties they owe to the world, and competent to discharge those duties with wisdom and

intelligence. Above all, let us cherish public and private virtue as the best and surest foundation for national happiness; and then, when the days which Providence may allot to us as a people, have been fulfilled, succeeding ages may find in our institutions, monuments, and history, the lights which will guide them to the same honorable elevation that we have reached; and beacons to warn them of the errors which have marked our decline and downfal.

Eleventh Exhibition of Domestic Manufactures held by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

To the Managers of the Franklin Institute:

The Committee on Premiums and Exhibitions respectfully present their Report in relation to the Exhibition which has just closed.

The preparations for holding the exhibition were in general similar to those which were made in the years just preceding this. A circular, giving notice of the time of holding the exhibition and soliciting contributions to it, was widely distributed. The number of premiums and the specific kind of articles for which they were to be awarded, were again left to be determined at the exhibition itself, a course adopted at the last exhibition, and in relation to which the advantages anticipated by the Committee have been fully realized.

Preliminary meetings of a Committee of Arrangement were held at the Hall of the Franklin Institute, during the month of September, and were attended by upwards of one hundred members. At these meetings sub-committees were appointed to obtain and arrange specimens in the different departments of the Arts and Manufactures, and the reports made from time to time of their progress, showed great zeal and spirit in the performance of their duties, and gave promise of the results subsequently attained.

It is believed that the Committee on Premiums and Exhibitions has been enabled, by the experience of past years, materially to improve the general business arrangements of the exhibition. The distribution and arrangement of the rooms, the erection of the temporary building in front of the Hall, the opportunities of exhibiting the stoves and grates in action, with other minor matters promotive of the convenience of visiters and of the advantage of depositors, were all improvements on the similar arrangements of former years. The Committee were further enabled, by the kind co-operation of the gentlemen of the United States Mint, to have a supply of medals adequate to the probable demand prepared in anticipation, so that the actual delivery of the medal to a successful competitor for a premium might be made during the exhibition itself.

These endeavours having met a corresponding return on the part of the depositors of American products, and the choice of the articles which the market for the several kinds affords, has been presented for competition or submitted to the examination of the public. Many articles were prepared expressly for the exhibition, but it is to be remarked of this occasion more than of any which preceded it, that more articles in proportion were of the kind to be purchased by consumers, and not mere show specimens, of the best efforts of the manufacturer. The result is highly gratifying, as showing considerable progress in many departments of industry. Much of this result may fairly be claimed for, and part of it is directly traced to, former

exhibitions here or elsewhere. Of course, if there is no demand for an article, the mere award of an honorary premium or medal, however gratifying to the producer, will not secure a steady advance in, or even the continuance of, a manufacture, but in the articles for which there is a real demand, such exhibitions promote improvements in various ways. The condition of the manufacture is spread before the manufacturers themselves, and they are incited to exertion to carry it a step forward, to outdo their former efforts or those of competitors. They see what is required, and their ingenuity is set to work to produce it. The public see the results of this competition and effort, their observation induces them to supply themselves with the articles they require from approved sources, the relative merits of different products are canvassed, the manufacturer feels immediately, or in time, the consequences of his successful labour, and in some cases considerable orders are given during the very exhibition itself. It is almost impossible that a branch of manufacture should remain stationary under the influence of these exhibitions; experience shows, on the contrary, that the advance in many is so rapid that articles which at one time have been highly praised become obsolete, if not subsequently improved upon.

The public have patronized this exhibition well, notwithstanding many unfavorable circumstances connected with the time of holding it, and the unusual character of the weather for a considerable part of the fortnight during which it was continued. Committees from the Massachusetts Charitable Mechanics' Association of Boston, from the Mechanics' Institute of New York, and from the American Institute of the same city, have visited our exhibition, the compliment was the greater on the part of the latter society, as they were themselves holding a similar fair, requiring great activity and energy in the members to carry it successfully on. It is believed that all these gentlemen were satisfied with the results of their visits, and in referrence to some particular departments, they did not hesitate to award the palm of merit to our mechanics.

By invitation of the Committee on Premiums, a part of the pupils of the Public Schools, and of some other institutions of our city, with their teachers, attended the exhibition, and it is hoped with immediate advantage to themselves, and perhaps with more important prospective benefit.

Great efforts have been made to induce punctual attendance and prompt reports by the committees appointed to judge of the relative merits of articles submitted for competition, and with good success. The Committee on Premiums, on their part, have given corresponding attention to the award of premiums and certificates, and to the preparation of their report; and it is a distinguishing feature of this exhibition that the medals and honorary certificates were awarded during the exhibition itself. At the same time the arrears of former years in the delivery of medals were brought up, and the members of the Institute had an opportunity of hearing an excellent and appropriate address on the connexion of Commerce and the Mechanic Arts, by the Treasurer of the Institute, Frederick Fraley, Esq.

As the awards of certificates at these exhibitions are more generally for improvement or perfection in manufacture than for novelty in invention, a certain class of models and machines has not heretofore met with all the attention which, in the opinion of many, they deserve. This defect has been remedied by referring such articles to the attention of the Committee on Science and the Arts, by whom, if desired by their inventors, they will be duly examined, and who are authorized by the city authorities to award, un-

der the Scott's legacy, medals and premiums for meritorious inventions. The careful investigation which such matters require is thus secured for them.

The Committee now proceeds to give a general view of the results of the exhibition, the awards of premiums and certificates being usually made in conformity with the reports of the judges; the Committee having, however, the power of, and exercising a discretion in, revision, when the cases seem to them to require it, and having made personal examination when the judges omitted to report, they have endeavoured to do what was right in the premises. As usual, many articles have been excluded from certificates by being brought to the exhibition after the specified time, the Committee having only sparingly and in special cases exercised the right reserved to themselves of examining articles of considerable claims to merit, but which were excluded from the examination of the judges by being presented too late for that purpose.

Cotton Goods.

The goods exhibited in this department were, very generally, samples of those to be had in quantities in the stores, and fully sustained the character of the exhibition. A more particular account of them with remarks from the judges, will be appended to this report. The Committee has, in conformity with the report of the judges, made the following awards:

To J. Dunnell & Co., of Pawtucket, R. I., for samples, No. 629, six pieces of $\frac{4}{4}$ chintz prints, "of superior excellence. The printing consisting of several colours, unusually perfect, and the style beautiful."

A Silver Medal.

To James C. Kempton, of Manayunk, Pennsylvania, for his power loom ginghams and power loom checks. (No. 435.)

The judges state that these are new articles, and that the "entire execution including the dyeing, is very superior." As the weaving with three shuttles on the power loom is supposed to be a novelty, the subject has been referred for examination to the Committee on Science and the Arts, and in the mean time the Committee awards for the execution of the goods prescribed,

A Silver Medal.

To Ebenezer Rhoads, Boston, Massachusetts, for white cotton counterpanes, (No. 257.) A Certificate of Honourable Mention.

To Smith, Dove & Co., of Andover, Massachusetts, for No. 290, deposited by Parker & Iddings, shoe thread of uniform fineness and due strength,

A Certificate of Honourable Mention.

To John Hopkins, of Philadelphia, for No. 674, cotton and woolen hose, shirts and drawers, of "fair texture, and for durability and service, at least equal to the imported," A Certificate of Honourable Mention.

To the Rockland Manufacturing Company, for specimens of cotton yarn, (No. 879.) A Certificate of Honourable Mention.

Woolen Goods.

The samples of woolen goods were not as numerous, nor as varied as in former exhibitions; nevertheless the display was creditable to the manufacturers. In conformity with the remarks of the judges, the Committee has made the following awards:

To the Middlesex Manufacturing Company, for cloth No. 250 and 251, deposited by the makers—and consisting of olive, brown, and blue diamond cloth, and of green and blue asphaltum cloth of superior style and finish,

A Silver Medal.

The judges remark of the diamond cloth, that it is a new article.

To the Middlesex Manufacturing Company, for lot No. 250, deposited by the makers, Wool black and Oxford mixed cassimeres.

A Certificate of Honourable Mention.

The wool black cassimeres of this lot were particularly admired.

To Edward Harris, Woonsocket, R. I., for lot No. 252, deposited by the manufacturer—blue and cadet mixed jeans, in relation to which, while the specimens are considered very beautiful, more weight is deemed desirable.

A Certificate of Honourable Mention.

To the Mechanics' Manufacturing Company, of Rochester, New Hampshire, for specimens of three point white, scarlet, and green Mackinaw, and of satin bound and embroidered milled bed blankets, (No. 314.)

A Certificate of Honourable Mention.

To the Salisbury Manufacturing Company, of Boston, for lot No. 575, deposited by Waln & Leaming, and consisting of specimens of printed scarlet flannel, and thirty-six and forty-five inch white shirting flannel.

A Certificate of Honourable Mention.

To J. & J. Eddy, Fall River, Massachusetts, for No. 689, specimens of double-milled drab sattinets, "very heavy and firm, and well coloured."

A Certificate of Honourable Mention.

To the Ballard Vale Co., Massachusetts, for lot No. 792, $\frac{4}{4}$ and $\frac{7}{8}$ white flannels. A Certificate of Honourable Mention.

Several articles in this department were, owing to the late period at which they were brought to the exhibition, excluded from competition.

Wool.

A beautiful specimen of wool from was deposited by C. Houston & Co., and the Committee believing that this may hereafter become an article of great importance to the United States, and desirous of competition in it at future exhibitions, awards

A Certificate of Honourable Mention.

Carpets.

To George Dudley, of Philadelphia, for No. 36, a superior imitation Brussels carpet, much admired. A Silver Medal.

The velvet pile carpet of the same maker, was in too small a quantity to obtain a special mention, though the quality was deemed excellent.

The tufted rug, by the same maker, was considered good both in quality and colour.

To Isaac Macauley, of Philadelphia, for No. 762, deposited by the maker, oil cloths of excellent quality and colours.

A Certificate of Honourable Mention.

To George W. Duncan, of Philadelphia, for No. 56, deposited by the maker, oil cloths for table covers. A Certificate of Honourable Mention.

Silk.

The display in this department was decidedly superior to that of former years, and satisfactorily shows that certain articles have actually taken their places among the manufactures of our country. The specimens of sewing silk were of good quality and colour, and the material prepared for this manufacture was presented in considerable quantity. The following awards are made:

To the Philadelphia Silk Culture and Manufacturing Company for sewing silks of assorted colours, of good quality, and well dyed, deposited by E. O. Abbott. A Silver Medal.

To Mrs. H. M'Lanahan, Superintendent of the Model Filature at Philadelphia, for a small but beautiful specimen of reeled silk, prepared by herself. A Silver Medal.

To Thomas R. Fisher, of Germantown, Pennsylvania, for silk stockings, gloves, drawers, &c., manufactured by him.

A Certificate of Honourable Mention.

To the Association of New Harmony, Pennsylvania, for a specimen of figured silk ribbon, deposited by Charles Joy.

A Certificate of Honourable Mention.

The Committee regret that the late date at which the sewing silk and other articles, made by John Wilbank, of Philadelphia, were deposited, excluded them from the notice of the judges. The specimens of sewing silk and silk handkerchiefs deposited by Adam Brooks, derived special interest from the fact that the manufacture is understood to be conducted at one process (on a machine of his invention) from the cocoon to the manufactured articles; the Committee had not sufficient information herein to enable them to make an award in the matter.

Iron and Steel.

In this useful department the report of the judges is full and explicit, and the awards have been made according to their recommendations.

To the Boonton Iron Works, New Jersey, for a specimen of wrought iron manufactured by anthracite coal, and from anthracite pig metal.

A Silver Medal.

The pig metal was made at the Crane Iron Works, and the judges remark of the malleable iron, that it is of good quality; they refer also to the statement of the maker, that the pig metal was converted into malleable iron with a very trifling cost, and derive great encouragement from it in reference to the future prospect of the manufacture of Iron by anthracite in our country.

To Savery & Co. of Philadelphia, for their specimens of hollow iron, and other iron castings of beautiful execution. A Silver Medal.

The fine castings, by Levi Morris & Co., are beautiful specimens of the art of the founder,—the ornamental iron dishes and castings of the Madonna, are a near approach to the Berlin castings. As Isaac P. Morris of this firm is a member of the Board of Managers of the Institute, the Committee can make no awards.

To Yearsley and Forsyth, for three sheets of boiler iron of unusually large dimensions, deposited by Morris & Jones.

A Certificate of Honourable Mention.

One of the sheets is ten feet six inches in length by thirty-one in breadth; it is from a charcoal bloom, and each sheet is said to have been rolled at one heat.

To Valentines & Thomas of the Bellefonte and Juniata Iron Works, for several specimens of iron, deposited by E. J. Etting & Brother.

A Certificate of Honourable Mention.

To the Coleman Iron Works, Mastic Forge, Lancaster county, for a specimen of pig iron made from charcoal with the hot blast, by the run out process. A Certificate of Honourable Mention.

Specimens of anthracite pig iron, were also deposited by W. R. Johnson, by Baughman Guiteau & Co., by Biddle, Chambers & Co., on which the judges remark, that they are all good, and present considerable varieties in their qualities, adapting them to different uses.

The judges were of opinion that the plate exhibited was not superior to that presented at former exhibitions.

Lamps and Gas Fixtures.

There was not a great variety in the articles of this kind exhibited, but some were of great excellence. The Committee makes the following awards:

To Cornelius & Co., for several lamps and gas fixtures, deposited by them. A Certificate of Honourable Mention.

The judges are informed that the silvered mounting of some of the articles exhibited by Messrs. Cornelius, is covered with a varnish, which, though not perceptible to the eye, protects the silvering from the action of gases.

To the Boston and Sandwich Glass Company, of Massachusetts, for two glass shades of pendant hall lamps, of a hexagonal form, and cast in one piece, deposited by W. M. Muzzey.
A Certificate of Honourable Mention.

Hardware and Cutlery.

The collection of these articles did great credit to the manufacturers, and manifested excellent judgment on the part of the Committee of Arrangement who had displayed them. The specimens are generally of the kind sold by the best makers and retailers, and show great perfection in this department of the arts. When all the specimens are so good, distinction becomes very difficult, and the Committee have in general been guided in their awards by the improvement manifested over articles formerly exhibited, or by the novelty of the articles.

To G. & D. N. Ropes, of Portland, Maine, for knives and forks of beautiful finish. (No. 295 and 300.) A Silver Medal.

To Leonard Reed & Barton, of Taunton, Massachusetts, for specimens of Britannia ware, deposited by S. D. Hastings, and Krug & Colladay. (No. 800.) A Silver Medal.

To J. Rittenhouse, of Germantown, for coffee mills, with very little friction, and beautifully finished. (No. 194.) A Silver Medal.

To Joseph Lingard, of Philadelphia, for samples of gun locks, a new article. (No. 751.) A Silver Medal.

To R. Heinisch, of Newark, N. J., for tailors' shears, improved since the last exhibition, deposited by Charles Harkness. (No. 584.)
A Silver Medal.

To Thomas Cooke, of Norwalk, Connecticut, for door knobs of woods of different colours. (No. 672.) A Certificate of Honourable Mention.

To Luther Fox, of Taunton, Massachusetts, for his carpenters' planes, deposited by B. Horner. (No. 331.)
A Certificate of Honourable Mention.

To the New Hope Lock Manufacturing Company, for the specimens of

Ball's lock without springs, deposited by Charles Carpenter. (No. 650.)
A Certificate of Honourable Mention.

As this lock is supposed to be upon a new principle, it is referred for particular examination to the Committee on Science and the Arts.

To the New England Screw Company, for specimens of wood screws, deposited by Carr & Keim, a cheap and good article.
A Certificate of Honourable Mention.

To William Rowland, of Philadelphia, for his saws, showing their usual excellence. (No. 155.) A Certificate of Honourable Mention.

To William and Charles Johnson, of Philadelphia, for a collection of admirably finished saws and Carpenters' tools. (No. 124.)
A Certificate of Honourable Mention.

To J. Russell & Co., of Greenfield, Massachusetts, for chisels and knives, well finished, deposited by Curtis & Hand. (No. 712.)
A Certificate of Honourable Mention.

To J. Paul, of Philadelphia, for edge tools. (No. 206.)
A Certificate of Honourable Mention.

These beautiful tools are understood to have been finished for the exhibition.

To Augustus Prutzman, of Philadelphia, for his door locks of ingenious construction and beautiful finish. A Certificate of Honourable Mention.

To J. Sloat of New York, for good specimens of screw traps, deposited by Carr & Keim. (No. 309.) A Certificate of Honourable Mention.

To the Douglass Manufacturing Company, of Massachusetts, for their edge tools, deposited by Collins & Brothers. (No. 683.)
A Certificate of Honourable Mention.

To the Taunton Manufacturing Company, of New Jersey, for their edge tools, deposited by Livingston & Lyman. (No. 462.)
A Certificate of Honourable Mention.

To James Williams, Camden, N. J., for specimens of edge tools, deposited by R. Lesley, of Philadelphia. A Certificate of Honourable Mention.

These tools were probably the most highly finished presented for exhibition, but as no evidence was presented that they were not prepared for this purpose, the Committee could not make a higher award.

To Thomas Wildes, of New York, for specimens of Britannia ware, deposited by S. D. Hastings. (No. 635.)
A Certificate of Honourable Mention.

To Thomas Loring, of Philadelphia, for plated cast iron andirons, a beautiful article. A Certificate of Honourable Mention.

To E. W. Bushnell, of Philadelphia, for tools for carpenters, and for skates. (No. 522.) A Certificate of Honourable Mention.

Richardson's eccentric door springs, (No. 286.) are referred for examination to the Committee on Science and the Arts.

The articles manufactured by W. H. Carr, and deposited by Carr & Keim, consisting of hay and manure forks, &c., were very creditable; but as Mr. Carr is a member of the Board of Managers, are passed over without special notice.

Leather and Manufactures of Leather.

The Committee have made the following awards in this department:

To Samuel A. Hagner, of Philadelphia, for a very light and neat set of single harness. A Certificate of Honourable Mention.

To William Morris, of Philadelphia, for a set of single harness of similar quality. A Certificate of Honourable Mention.

To W. N. Lacy, of Philadelphia, for a set of coach harness.
A Certificate of Honourable Mention.

To Charles L. Pascal, of Philadelphia, for a military saddle.
A Certificate of Honourable Mention.

To E. Pearce, of Philadelphia, for a sulky bridle, rounded without a seam. A Certificate of Honourable Mention.

To T. Moyer & Son, of Philadelphia, for various specimens of saddles, of excellent workmanship. A Certificate of Honourable Mention.

To Alexander L. Hickey, of Philadelphia, for traveling trunks, ingeniously contrived and well made.
A Certificate of Honourable Mention.

To Daniel McGovern, for a pair of leather coach collars.
A Certificate of Honourable Mention.

To James E. Brown, for a leather traveling trunk.
A Certificate of Honourable Mention.

To Pearson & Sallada, of Philadelphia, for specimens of riding whips.
A Certificate of Honourable Mention.

To Mahlon Warne, of Philadelphia, for specimens of covered buckles, superior to the best imported. A Certificate of Honourable Mention.

To McConnell & Avery, of Boston, Massachusetts, for specimens of japanned leather. A Certificate of Honourable Mention.

To A. & J. Peterson, for two very large well tanned hog skins for saddle seats. A Certificate of Honourable Mention.

To E. W. Walker, of Pawtucket, Rhode Island, for specimens of sheep and calf skins, for printers' rollers, &c.
A Certificate of Honourable Mention.

To Kinsey & Taylor, for specimens of Morocco leather.
A Certificate of Honourable Mention.

To Hummel & Son, for well prepared goat and buck skins, fancy colours.
A Certificate of Honourable Mention.

To Aymer & Fritz, for goat skins, or French morocco, dressed with and without oil, excellent articles. A Certificate of Honourable Mention.

To John Lippincott, for chaise-top, lining, and bag hides, of excellent finish. A Certificate of Honourable Mention.

To Scattergood & Boustead, for a calf skin dressed on the grain.
A Certificate of Honourable Mention.

The last named article being supposed to present an improvement where leather is used for boots and shoes, has been referred for examination to the Committee on Science and the Arts.

Stoves and Grates.

The variety of articles under this head, for parlour or kitchen use, was very considerable, and many of the latter kind were repeatedly under trial during the exhibition. In accordance with the remarks of the judges, the Committee awards:

To J. W. Kirk & Co., of Philadelphia, for their improved cooking stove.
A Silver Medal.

To Isaac Ten Eyck, of Philadelphia, for a stove for cooking with wood.
A Certificate of Honourable Mention.

To J. J. Hess, of Philadelphia, for his cooking stove.
A Certificate of Honourable Mention.

To H. H. Stimpson, of Boston, Massachusetts, for a cooking range.
A Certificate of Honourable Mention.

To Samuel Lloyd, for his improved Barrows' cooking range.
A Certificate of Honourable Mention.

To Samuel R. Andrews, of Philadelphia, for a cooking range for the use of a large family. A Certificate of Honourable Mention.

To Weaver & Volkmaar, of Philadelphia, for No. 580, a parlour stove of superior workmanship. A Certificate of Honourable Mention.

To Morris, Tasker & Morris, for a polished cast iron grate of superior workmanship. A Certificate of Honourable Mention.

The judges remark that the bars of the grates in the radiating stoves are too far apart to allow of the use of nut coal, which they consider a defect in their construction.

To Sherman & Co of North Marshfield, Mass., for rivets for sheet iron work, deposited by Harned & Elliott, a superior article to the imported.
A Certificate of Honourable Mention.

Models and Machinery.

The specimens of models and machinery were probably more varied and interesting than those of any other branch of the exhibition; the advance which they display over former exhibitions, is deserving of special notice, and commendation. The Committee have divided the articles into two classes, one of which being presented on account of perfection in workmanship, were considered as particularly competing for the awards at the exhibition, and others consisting of new inventions and ingenious combinations, requiring close, and deliberate examination—they have referred to the Committee on Science and the Arts, who are empowered to bestow the Scott's Legacy Premiums and Medals. A few of the more simple models, and of which the novelty was well ascertained, have been classed with the first mentioned articles. Many of the specimens of good workmanship were exhibited by Managers of the Institute, and although the result is gratifying to the institution, yet they are, of course, excluded from more than a mere mention. The following awards are made to the best articles exhibited:

To the High Street Machine Company, of Providence, Rhode Island, for a scroll or spiral chuck, deposited by D. W. Henderson, which has been approved as a convenient and useful tool. A Silver Medal.

To J. H. Stewart, of Philadelphia, for a fly press for printing cards, deposited by Thomas F. Adams, and used by him for printing during the exhibition. A Certificate of Honourable Mention.

To Marshall & Brock, of Philadelphia, for a slide lathe for heavy turning, deposited by Louis Lebanday.
A Certificate of Honourable Mention.

To Nicholas Wall, of Philadelphia, for a slide lathe for heavy turning, deposited by the maker. A Certificate of Honourable Mention.

To Philip Garrett, jr., for a neat and well finished foot lathe.
A Certificate of Honourable Mention.

To Jacob Lodge, of Philadelphia, for a very simple geared foot lathe.
A Certificate of Honourable Mention.

To Adam Ramage of Philadelphia, for a very simple copying printing press with a wrought iron frame.
A Certificate of Honourable Mention.

To W. M. Hartshorne, of Philadelphia, for a heavy punching machine, and a screw for a slide lathe. A Certificate of Honourable Mention.

To George Ruhl, of Philadelphia, for a hose carriage made for the Columbia Hose Company, a beautifully finished article.
A Certificate of Honourable Mention.

The axles by T. & M. Greer, are said to present novelty in arrangement, but the attention of the judges was not called to this fact in time to allow of an examination.

The following articles have been referred to the Committee on Science and the Arts, and the models will be retained by the Actuary, and an examination made of them, unless the depositors or owners desire to withdraw them.

A machine for cutting sole leather, by Jonathan Whipple, of Grafton, Massachusetts, deposited by Boustead & Shoemaker.

A model of an overshot wheel, by Robbins and Ashby of Bordentown, New Jersey, deposited by Rudolph Justice.

Models of improved lattice bridges, by Hermann Houpt, C. E., deposited by Thomas J. Houpt.

An engine for cutting the teeth of spur, bevel or crown gear, by W. M. Hartshorne of Philadelphia.

A machine for cutting circular plates from tin, by Andrew Tracy, of Poughkeepsie, New York.

A fire engine by Joel Bates of Philadelphia.

A model of an apparatus for supplying water to boilers, by B. M. Hyatt, of Wilmington, Delaware.

A machine for cutting the round tenons of spokes for wheels, by Mahlon Grigg, of Camden, New Jersey.

A machine for making the material of hat bodies, and the hat bodies, by H. S. Miller of Philadelphia.

Models of several machines already reported upon favourably by the Committee on Science and the Arts, were presented to the public, such as Naglee's turn-out for railroads; Schofield's water wheel governor; E. Bancroft's machine for straightening heavy-wrought iron bars, Isaac Babbit's soft metal boxes, for railway car axles, and others. A model of a caisson intended for laying the foundation of the light-house to be erected on the Brandywine shoal, by Major Bache, of the corps of topographical engineers, attracted considerable attention.

The Committee of judges speak in terms of the highest commendation of the heavy machinery made for the Government steam vessel, by Merrick & Towne, of Philadelphia. The main pedestals, of three tons in weight, they say, as "castings, have never been excelled in this country," and the wrought iron work they consider as alike deserving of high commendation. The accuracy of the joints in the work of the side links, rivals the best work usually put upon the British steam engines. The brass work of the gauge cocks, &c., is spoken of in like terms of high commendation. The castings for the brass work were made by John Agnew, of Philadelphia.

The Committee award a Certificate of Honourable Mention, to Charles Piggott, for moulding the main pedestals, and a Certificate of Honourable Mention to John Newsham, for forging the socket end of a bolt for holding down the pedestal.—Both of the above named young men are apprentices of Merrick & Towne and the articles are those just referred to.

Wire.

To Brown & Elton, of Waterbury, Connecticut, for a lot of copper and brass wire, deposited by Krug & Colladay.

A Certificate of Honourable Mention.

Plumbers' Work.

The specimens of lead pipes from one quarter inch to four inches in bore, intended for gas and water pipes, were all made by a particular process which the American patentee wishes to have examined by the Committee on Science and the Arts, to whom it has been accordingly referred. For the workmanship of these specimens the Committee award to Tatham & Brothers of Philadelphia. A Silver Medal.

Cabinet Ware.

This department was by no means as rich as usual in specimens; the forms of the articles exhibited do not appear to have improved, and though the workmanship of many was creditable, the judges were of opinion that no premium should be awarded. They recommend the following honorary mentions:

To John P. Seidel, of Philadelphia, for a well made lady's work table.

A Certificate of Honourable Mention.

To Moore & Campion of Philadelphia, for a wardrobe.

A Certificate of Honourable Mention.

To Crawford Riddell, of Philadelphia, for a secretary.

A Certificate of Honourable mention.

To J. & A. Crout, for a sofa of American wood.

A Certificate of Honourable Mention.

Musical Instruments.

The report of the judges on this subject is one of the most elaborate which has been presented to the Committee, and great pains were taken in examining the claims of different competitors. The following awards were made according to the recommendation of the judges, whose report will be published for reference.

To Brown & Hallett, of Boston, Massachusetts, for a six octave piano, of superior tone, and with a peculiar arrangement of the soft pedal, deposited by L. Meignen & Co. A Silver Medal.

To the New York Manufacturing Company, for a six and a half octave piano, deposited by William Swift, ranking next, and close to, the foregoing in the opinion of the judges. A Certificate of Honourable Mention.

To Thomas Loud, of Philadelphia, for a six and a half octave piano, of excellent touch and brilliant tone.

A Certificate of Honourable Mention.

To J. Pfaff, of Philadelphia, for flutes made by him.
A Certificate of Honourable Mention.

To O. M. Coleman, of Philadelphia, for his æolian lute.
A Certificate of Honourable Mention.

Glass Ware.

The display of glass ware has been excelled in beauty by former exhibitions, but the improvement in moulded glass has in no case appeared so strongly as on the present occasion. For common use this article has the recommendations of economy combined with considerable beauty of appearance; while it can be purchased for less than half the price of similar cut glass, a close examination is required to perceive that it has been moulded. The articles cut from moulded glass were also excellent, and are much cheaper than those technically known as cut glass.

To the New England Glass Company, for lot No. 350, of cut and moulded glass, deposited by S. D. Hastings, and for two cut glass decanters, deposited by W. M. Muzzey.
A Silver Medal.

To the Union Glass Company, of Philadelphia, for wine glasses cut over moulded glass. A Certificate of Honourable Mention.

To Coffin & Hay, of Winslow, New Jersey, for two glass shades for flowers. A Certificate of Honourable Mention.

This article has a slightly greenish tinge, which no doubt may be avoided; the shape is good, and the whole effort successful.

Books and Stationary.

The stationery exhibited presented an admirable view of the state of this branch of manufacture, so highly creditable to the United States. The Committee do not find, however, that any striking improvement has been made in this department in general since the last exhibitions, though some particular branches have advanced. The following awards are made :

To Thomas F. Adams, of Philadelphia, for his single and double enamelled visiting cards. A Silver Medal.

The beauty of the finish of these cards has never been exceeded; the glazed surface is not liable to scale, and it is said that the whitening material is different from that generally used, and the cards less exposed to darken by exposure to the air. They take an excellent impression from common types which are used in Mr. Adams' mode of printing.

To R. & A. H. Hubbard, of Norwich, Connecticut, for the improvement in the manufacture of blotting paper and of coloured printing paper, specimens of which were deposited by C. & W. H. Magarge.
A Silver Medal.

To A. C. & W. Curtis, Newton, Mass., for printing paper, of excellent quality, deposited by C. & W. H. Magarge.
A Certificate of Honourable Mention.

To C. & W. H. Magarge, of Philadelphia, for a specimen of wall paper, equal to the French article. A Certificate of Honourable Mention.

To Tileston & Hollingsworth, of Milton, Mass., for specimens of plate paper, of great beauty, deposited by C. & W. H. Magarge.
A Certificate of Honourable Mention.

To C. Sherman & Co., for a beautiful specimen of typography, (a copy of Lalla Rookh.) A Certificate of Honourable Mention.

To John H. Dohnert, for a great variety of marbled papers of good quality. A Certificate of Honourable Mention.

To S. C. & E. Mann, of Dedham, Massachusetts, for their marbled papers. A Certificate of Honourable Mention.

Various qualities of letter and writing papers from the manufactories of Jessup & Brothers, of Westfield, Massachusetts, Owen & Hurlbut, South Lee, Mass., H. & E. Goodwin, of Hartford, Connecticut, R. & A. H. Hubbard, of Norwich, Connecticut, D. & J. Ames, of Springfield, Massachusetts, Amies of Dove Mills, Montgomery county, Pa., and the Southworth Manufacturing Company, were exhibited, and in reference to prices, colour, uniformity, glazing, &c., merited high commendation.

To Crehore & Neal, for coloured tissue papers, deposited by C. & W. H. Magarge. A Certificate of Honourable Mention.

To John B. Kreymborg, Jr., for an assortment of quills, of very even quality. A Certificate of Honourable Mention.

The uniformity in the selection of his quills is said to characterize the articles of this young manufacturer.

Maps and Charts.

The principal contribution in this department was from H. Tanner, Jr., but two beautiful specimens of topographical work by Major H. Bache and Major James D. Graham, of the United States Topographical Engineers, were also deposited by one of the members of the Institute, and met with high commendation from those who are judges of such work. A map for the blind, by Dr. Rose, of the Pennsylvania Institute for the Instruction of the Blind, which has received the award of a Scott's Legacy Medal, was also exhibited.

The Committee awards:

To H. Tanner, Jr., of Philadelphia, for a variety of maps deposited by him. A Certificate of Honourable Mention.

To F. J. Roberts of Philadelphia, for a well executed map of Philadelphia. A Certificate of Honourable Mention.

Paper Hangings.

No department of the arts represented at the exhibition has made more progress than this, and the beauty of the specimens struck many persons with surprise. The following awards have been made.

To Howell & Brothers, of Philadelphia, for the excellence of the workmanship and variety of the paper hangings exhibited by them.

A Silver Medal.

To John Beaty, for the specimens of paper hangings, especially the patterns in bronze and velvet. A Certificate of Honourable Mention.

To Finn & Newland, for the paper hangings exhibited by them.

A Certificate of Honourable Mention.

To Charles Longstreth, for similar specimens.

A Certificate of Honourable Mention.

Fine Arts.

The report of the judges on the Fine Arts was received at so late a date

as to render it impossible to include their notices of the articles submitted to them at the public reading of the report of the Committee on premiums and exhibitions. In conformity with what appears to be the rank assigned by the judges to the different productions exhibited, the following awards are made:

To J. T. Bowen, of Philadelphia, for No. 458, specimens of lithography, "uncommonly fine and reflecting credit on American arts."
A Certificate of Honourable Mention.

To Francis Humphries, of Philadelphia, for No. 103, "beautiful vignettes." A Certificate of Honourable Mention.

To Draper, Toppan, & Co., of Philadelphia, for No. 419, beautiful spemens of bank note engravings. A Certificate of Honourable Mention.

To Wm. Humphries, of Philadelphia, for No. 687, a capital line engraving. A Certificate of Honourable Mention.

To Joseph E. Parker, of Philadelphia, for his specimens of heliography.
A Certificate of Honourable Mention.

The judges mention with approbation, No. 62, a portrait of Gov. Porter, by J. M. De França; No. 82, a portrait of a lady, by T. B. Welch; No. 101, a portrait of a lady, by J. L. Jahraus; No. 105 and 109, sketches for cottages, by J. Skirving; No. 134, a crayon drawing of drapery, by Geo. G. Heiss; No. 156, a mezzotint, by J. Sartain; No. 475, a sketch in body colour, by J. R Smith Jr.; No. 484, oil paintings, by J. A. Woodside; No. 83, an engraving by T. B. Welch.

The Committee further award to John Gibson, of Philadelphia, for his specimens of Graining (No. 479.) A Silver Medal.

Silver Ware and Plated Goods.

These branches of the arts have attained great perfection in our country; so much so that any quality of workmanship may be obtained which is desired. The specimens at the exhibition were not numerous, but were generally admired. The following awards are made:

To Bard & Lamont, for a highly finished tea set, pitchers, &c.
A Certificate of Honourable Mention.

To R. & W. Wilson for a tea set and pitcher, richly chased.
A Certificate of Honourable Mention.

To Benjamin C. Lotier, for a rich specimen of chasing, executed by himself. A Certificate of Honourable Mention.

To Taylor & Baldwin, of Newark, N. J., for a beautiful specimen of gold filagree work. A Certificate of Honourable Mention.

The Committee also awards, as a mark of encouragement,

To Henry Butler, an apprentice of Jacob Bennett, for two pairs of salt stands. A Certificate of Honourable Mention.

To Anthony Morris, an apprentice, for specimens of chasings in brass.
A Certificate of Honourable Mention.

Book Binders' Work and Tools.

This is one of the most improved departments of the exhibition, and one that has excited very general attention. Some of the specimens of binding were prepared for the exhibition, but most of them were not so prepared.

The beauty of the muslin binding, and the richness and good taste of its gilding, deserve high praise from the Committee. The following awards have been made:

To R. Lindsay & Co., of Philadelphia, for No. 40, specimens of binding, deemed the best hitherto exhibited in this city, from the current productions of the bindery. A Silver Medal.

To Gaskill & Copper, of Philadelphia, for the best specimens of bookbinders' stamps. A Silver Medal.

In regard to the last named specimens, the Committee deem them worthy of the highest commendation, and consider that the work shown in this department is quite on a par with the best English specimens.

To Samuel Moore, of Philadelphia, for the best bound single volume, prepared for the exhibition. A Certificate of Honourable Mention.

To Abel & Pomeroy, of Philadelphia, for various specimens of binding of very good finish. A Certificate of Honourable Mention.

To A. C. Morin of Philadelphia, for engraved steel plates for embossing. A Certificate of Honourable Mention.

Marble and Statuary.

The following awards have been made upon the report of the judges:

To Messrs. Lees & Bradley, of Philadelphia, for a marble mantel, with well executed foliage. A Certificate of Honourable Mention.

To Jesse D. Claypole, of Philadelphia, an apprentice, for a copy of Canova's sleeping lion. A Certificate of Honourable Mention.

To Theodore Hess, of Philadelphia, an apprentice, for a box of polished marble. A Certificate of Honourable Mention.

To Augustus Brookfield, "aged fourteen years," for a miniature monument. A Certificate of Honourable Mention.

The Committee take great pleasure in following out the policy of the Franklin Institute in encouraging youthful aspirants, by suitable marks of attention to their specimens. They must, of course, view these certificates of honourable mention as offered in the spirit of encouragement.

The best specimen of marble work in the exhibition was the cornice forming part of the monument to General Mercer, from the marble yard of John Struthers & Son ; but as Mr. Struthers is a member of the Board of Managers, no award can be made for this article. The Committee also passes over the mantels deposited by William Struthers, though highly commended by the judges, because he is one of the partners in a firm the elder member of which belongs to the Board of Managers of the Institute.

To Kelly & Farley, for their scagliola pedestals.
A Certificate of Honourable Mention.

The beautiful statue of the Fisherman's Daughter, by Pettrich, was entered by the liberal owner, General Keim, of Berks, only at the close of the exhibition; the well established reputation of the sculptor, and the public estimation of this particular work, render this a matter of less moment.

Hats and Caps.

At no previous exhibition has there been a display of articles in this branch equal to the one recently presented. The style, finish, and trimming, of the hats and caps, show much improvement. Some of the hats deposited

were made entirely and finished by the depositors, and others finished merely, and the Committee have been guided in their awards by that fact. They have awarded,

To Charles Oakford, for a case of hats, manufactured and finished by him, and of excellent workmanship. A Silver Medal.

To E. Kimber, Jr., for a case of substantial hats, made and finished by him. A Certificate of Honourable Mention.

To Mr. John Simpson, for a case of military and other hats and caps. A Certificate of Honourable Mention.

To S. H. Hare, for the hats and caps deposited by him. A Certificate of Honourable Mention.

To Charles Bulkley, for the hats and caps deposited by him. A Certificate of Honourable Mention.

The hats deposited by Thomas Evans & Co., by Bird Brothers, by C. C. Raphun, by Edward Damai, by Woodruff & Kester, by Oliver Brooks, and by S. D. Walton, were creditable specimens. The otter cap by Oliver Thacher, was also well got up.

Combs and Brushes.

There were not very many specimens of this manufacture, but those presented were highly creditable. The judges particularly notice the following, to which awards are made:

To G. W. Morris, for his blending brushes, a new article. A Certificate of Honourable Mention.

To S. Winner, of Philadelphia, for No. 80, deposited by maker, for one card of tortoiseshell combs. A Certificate of Honourable Mention.

To M. Busch, of Philadelphia, for one case and six cards of brushes. A Certificate of Honourable Mention.

To the pupils of the Pennsylvania Institution for the Instruction of the Blind, for specimens of brushes manufactured by them. A Certificate of Honourable Mention.

Coach Work.

To Ogle & Watson, for excellent specimens of coach work. A Certificate of Honourable Mention.

Boots and Shoes.

The number of specimens in this branch was small, and though it included some good work, the Committee does not feel warranted in making any special awards.

Chemicals.

The collection of chemicals was creditable, showing decided progress in the number, as well as the quality, of articles now manufactured. In reference to those which were deposited in time for competition, the following awards have been made. Remarks upon the colours exhibited, will be found under another head.

To Farr & Kunzie, for specimens of sulphate of quinine, nitrate of silver, red precipitate, and corrosive sublimate, deposited by them. A Certificate of Honourable Mention.

To Smith & Hodgson, for the biniodide of mercury, and narcotine, deposited by them. A Certificate of Honourable Mention.

To Wetherill & Brothers, for the red precipitate and calomel deposited by them. A Certificate of Honourable Mention.

To Campbell Morfit, for specimens of piperine, benzoic acid, tannin, sulphate of morphia, phosphate of soda, and iodide of potassium.

A Certificate of Honourable Mention.

The crystals of alum, by N. Lennig, & Co., the phloridzine, by Richard Price & Co., were particularly commended by the judges, as also the putting up of the Siedlitz powders of Merrick & Haskell.

To A. Gölsh, for his friction matches without sulphur.

A Certificate of Honourable Mention.

Philosophical Apparatus.

The number of these articles was increased beyond that of former exhibitions, and a general improvement was shown in those deposited. The Committee regretted to see no specimens of surveyors' and engineers' instruments, for the making of which our city enjoys a deserved reputation. The Committee recommended the following awards:

To Alva Mason, of Philadelphia, for an electrical machine, air pump, mechanical powers, &c., deposited by him.

A Certificate of Honourable Mention.

To D. Davis, Jr., of Boston, for various articles of magneto-electric apparatus, quite equal to those of the same kind from London.

A Certificate of Honourable Mention.

To Stephen Heintz, for areometers and thermometers, made by him.

A Certificate of Honourable Mention.

To W. G. Mason, for various specimens of medals, and a copy of an engraved plate, by the electrotype process.

A Certificate of Honourable Mention.

To George W. Hollingsworth, of Philadelphia, for his steel rulers and triangles, plain and wriggled. A Certificate of Honourable Mention.

As this is a desirable article for engineers, the Committee makes the above award, mentioning at the same time that very great exactness should be aimed at in instruments of this character, greater than has been attained in some of these articles.

The Newtonian telescopes, deposited by Messrs. Parkerson & Forten, could not be examined during the exhibition, without withdrawing them from the inspection of the public; it was intended to have done this on one of the last days of the exhibition, had the weather proved suitable; as this has not been the case, the instruments are referred for examination to the Committee on Science and the Arts.

Surgical Instruments.

The judges recommend and the Committee has made the following awards:

To Pugh Madeira, of Philadelphia, for a case of dental instruments, made for Messrs. Chiles & Birkey. A Silver Medal.

To H. Habermehl, for his operating table for dentists' tools.

A Certificate of Honourable Mention.

To Horatio G. Kern, for his dental instruments.
A Certificate of Honourable Mention.

To S. W. Stockton, for specimens of single artificial teeth, for setting.
A Certificate of Honourable Mention.

To H. S. Burr, for specimens of artificial teeth.
A Certificate of Honourable Mention.

The judges were of opinion that the best single artificial teeth, were by Mr. S. W. Stockton, and the best of those in sets and blocks, by H. S. Burr; in regard to the latter they remark that they exhibit a gradation of colour towards the points, and a translucency which distinguish them from all other specimens of artificial teeth that have fallen under the observation of the Committee.

Copper and Brass.

The articles of copper and brass manifested much improvement in this branch of the arts. The Committee awards,

To L. Debozear, of Philadelphia, for a bell, of rich tone, and good figure and proportions. A Silver Medal.

To Isaac Babbitt, of Boston, for a set of brass castings, the best which have come under the notice of the Committee. A Silver Medal.

To Joseph Oat, of Philadelphia, for tubes for the boilers of locomotive engines. A Certificate of Honourable Mention.

To Hill & Chamberlain, of Boston, for a similar article.
A Certificate of Honourable Mention.

To John McDavitt, of Philadelphia, for a copper tea kettle.
A Certificate of Honourable Mention.

Japanned Work.

The specimens of Japan ware exhibited were of beautiful workmanship, quite equal to those imported, and the Committee awards,

To Daniel Dick, of Philadelphia, for specimens of tea-trays and grocers' canisters of Japan ware. A Silver Medal.

Plated and Steel Saddlery.

The contributions in this department were few in number. The Committee awards,

To C. W. Ingram, of Philadelphia, for his bits and other saddlery,
A Certificate of Honourable Mention.

Guns.

The guns presented were of great merit. The judges, after a critical examination and trial of their merits, decline making any distinctions, and recommend the following awards, which are confirmed by the Committee:

To J. Krider, of Philadelphia, for three rifles, deposited by him.
A Certificate of Honourable Mention.

To William Robinson, of Philadelphia, for a rifle, a rifle and shot gun, and a double barrelled shot gun. A Certificate of Honourable Mention.

To D. Schwarzwälder, of Philadelphia, for a rifle and shot gun:
A Certificate of Honourable Mention.

To Hazeltine & Cumming, of Philadelphia, for a rifle, exhibited by them.
A Certificate of Honourable Mention.

To Tryon, Son & Co., of Philadelphia, for a rifle, deposited by them.
A Certificate of Honourable Mention.

To Jacob Koonz, of Philadelphia, for a rifle and traveler's gun.
A Certificate of Honourable Mention.

The revolving-chamber pistol, by Colt, was not in order, and could not, therefore, be specially examined.

Paints and Colours, Enamels and Stained Glass.

The difficulty of deciding correctly of the relative merits of colours by such trials as can be made at an exhibition, has induced the judges to abstain from speaking positively in reference to many of them. The Committee accordingly awards,

To Wetherill & Brother, for specimens, No. 166, of white lead, Prussian blue, and chrome yellow. A Certificate of Honourable Mention.

To Jewett & Sons, Brooklyn, N. Y., for lot No. 754, white lead, dry and ground in oil. A Certificate of Honourable Mention.

To Charles J. Crease, of Philadelphia, for specimens of chrome green.
A Certificate of Honourable Mention.

The varnishes by Wm. M. Humes and by Clemens & Baker were commended by the judges.

To T. Thomas, of New York, for specimens of stained, coloured, and painted glass, parts of which are the best yet exhibited.
A Silver Medal.

To Edwin Bishop, for specimens of enameling, the materials of which are of American manufacture. A Silver Medal.

Of these articles the judges remark, that "the stained glass deserves high commendation, from the variety, brilliancy, and transparency of the tints, and from the fine execution of one of the sketches, resembling an India ink sketch. The Committee believes part of these specimens to be superior to any which have been exhibited in this city, and deserving of especial notice."

"The specimens of enameling are remarkably beautiful in colour, execution, and finish of the glaze, and as every material employed in them is made in this country and city, by a citizen, and as the finished article can be produced at lower rates than the imported, it is believed that more than a mere commendation should be awarded."

Fancy Articles.

The miscellaneous character of the articles grouped under this head, makes the task of discrimination much more difficult than in the case of many more important departments of the exhibition; and the Committee are much obliged by the attention of the gentlemen who have been appointed as judges. In the opinion of these gentlemen, this department sustains the same character which it had on former occasions; they remark, however, that "a small number of articles have been admitted which ought to have been excluded, on account of their trivial and commonplace character, their faulty, and tasteless design, or imperfect workmanship." They go on to say, that they "do not refer to the works of children, for which every allowance ought to be made, but to the crude or hasty labours of tyros in the arts."

The following awards are made, in conformity with the report of the judges:

To J. S. Little, of Philadelphia, for Nos. 88 and 121, garden vases and ornamental work of artificial stone. A Silver Medal.

The forms of the dogs, vases, &c., were much admired, and certificates of durability under exposure to the weather for several years, were submitted from satisfactory sources.

To E. Kirk, of Philadelphia, for No. 326, highly improved anthracite ware. A Certificate of Honourable Mention.

The judges observe, that "Mr. Kirk has been engaged in this manufacture for about five years, and deserves great praise for his perseverance under so many difficulties." They consider that the improvement in the forms of the ware might still be carried further.

To John Thornly, of Philadelphia, for No. 225, a variety of India rubber shoes. A Certificate of Honourable Mention.

To J. L. Ripley, of Philadelphia, for No. 231, specimens of similar articles. A Certificate of Honourable Mention.

These articles consist of socks, over-shoes, shoes plated with gum, life-preservers, &c. They were well made, and certificates of durability, satisfactory to the judges, were laid before them.

To T. B. Smith, of Philadelphia, No. 27, for various assorted pickles, &c., of excellent flavour and good appearance.
A Certificate of Honourable Mention.

To C. D. Baker, of Philadelphia, for specimens of martinoes, No. 725, pronounced of good quality.

To Mrs. Hall, of Philadelphia, for No. 162, a piano cover, embroidered on cloth, a very beautiful article. A Certificate of Honourable Mention.

To Mrs. J. C. Evans, of Philadelphia, for a box of artificial flowers, (No. 763,) considered by the judges to be the best in the exhibition.
A Certificate of Honourable Mention.

To Phoebe Ayres, Philadelphia, for a silk quilt, No. 247, deemed the best exhibited. A Certificate of Honourable Mention.

To S. W. Horn, Philadelphia; for seven vases of wax flowers and fruit, of beautiful execution. A Certificate of Honourable Mention.

The judges have also noticed with commendation,

A boat beautifully modeled and finished by George James, in which, however, they would "prefer a sharper or more concave bow, as better adapted to attain the maximum velocity."

A lot of brass-bound buckets, an umbrella stand, seives, and sundry other articles of housekeeping, of good finish, by Wm. Boyer and Wm. Bransby; Nos 476 and 477.

A model of the ship Pennsylvania, by Jos. O. Sawyer.

A frame of botanical specimens from the herbarium of Peter A. Browne, of Philadelphia, remarkable in general for the preservation of the colours of the plants.

A specimen of hemp from the aloe, from the American Colony at Liberia; deposited by Elliott Cresson, Philadelphia.

A specimen of worsted work, (Little Red Riding Hood,) by Mrs. Thos. Sergeant, Philadelphia; one of the two best specimens in the exhibition.

A specimen equal to the one just mentioned, but a different style and subject; No. 741, deposited by Dr. Chaloner.

Specimens of crape and silk flower work, (820) by Mary Ann Knecht, (774) Sarah Elsegood, (745) Mrs. J. Rapp, the relative excellence of which the judges could not determine.

Silk stocks (No. 185,) made by C. A. Walborn, Philadelphia, very light and elastic, and the workmanship good, but made of foreign material.

Fine corded linen collars (No. 377), made by Miss Mary Brown, "neater than any heretofore brought to this market."

In conclusion, the Committee beg leave to return thanks to those gentlemen who acted on the Committee of Arrangement, and to whom much credit is due for the display in their different departments; the labour performed by them is highly appreciated by the Franklin Institute, and, doubtless, also by the public. To those also of the judges who have favoured the Committee with their judgment on the articles examined by them, the Committee would also return their thanks. The Committee appends to its report some of the reports of the judges, which appeared particularly full, or in which the interest of the subject seemed to render the presentation of these details desirable to the public.

Progress of Practical and Theoretical Mechanics and Chemistry.

A new Process for making Gas for Illuminations from Bituminous Schist.

The utilization of bituminous schist is a subject of great importance, as promising to make this substance profitable. M. Selligue is the inventor of the process for distilling this mineral, and has works for the purpose on a large scale. His mines are in the department of Saone and Loire, between Autun and the Central Canal, his three works are at St. Leger-du-Bois, Canton of Epinal; Surmoulin, near Autun, and Igernay, Canton of Cardesse. In these works the schist is distilled in close retorts, they leave a residuum of carbonaceous matter, which may be used for disinfection or discolouration, but not yet made serviceable. The volatile products are oils consisting principally of different carburets of hydrogen, which are made available for profit. A great quantity of inflammable gases are also disengaged during the distillation, and are directed into the furnace and used as a combustible.

The schists of Autun are very variable in character, but all are rejected which afford less than six per cent. of oil on distillation, but those now used average ten per cent., it is not rare, however, to find as much as twenty or twenty-five per cent., some afford as much as half their weight of oleaginous products.

The composition of 100 parts of liquid bitumen is as follows:

Light oil of variable density from 0.766 to 0.810, used for gas	35.57
Oil of greater density susceptible of being used in lamps	25.85
Fatty matter containing 12 per cent. of *paraffine* - -	12.
Pitch or tar - - - - - - - - - -	17.28
Residue - - - - - - - - - - -	9.3
	100

It has long been suspected that the olefiant gases derive their illuminating properties from the oleaginous vapours which accompany the generally

slightly carburetted hydrogen gas which always forms the base of these gases. M. Pelletan maintained this view in a paper read before the Academy in December, 1816, and it has been confirmed by M. Selligue. It has been, on the other hand, asserted and received as certain that oxidated carbonic gas is always injurious in illuminating gas, and that it diminishes the brilliancy of the flame by lowering its temperature, on account of the low degree of heat developed during its combustion. M. Selligue has, however, established the fallacy of this doctrine.

M. Selligue's process is as follows:—Three tubes, or retorts, situated vertically in a new and ingeniously constructed furnace, are heated red. The first and second contains charcoal, and as fast as the charcoal disappears it is replaced, which is every five hours. This carbon is for the purpose of effecting the decomposition of the water introduced into the first tube in a continued stream, and where it is converted into hydrogen gas, carbonic acid, and oxide of carbon. But as the production of carbonic acid is to be avoided, the gases produced by the first tube are conducted into the next, where they are exposed again to incandescent charcoal, by which means the carbonic acid first formed is converted into oxide of carbon. The furnace is so arranged that this tube is the hottest of the three, so as to favour the total decomposition of the carbonic acid.

The third tube is filled with iron chains, the use of which is to present a large incandescent metallic surface, capable of distributing caloric in an equal and rapid manner to the gases or vapours passing through. On the one side this tube receives the gases produced by the decomposition of the water in the two preceding tubes, and in the other a continued stream of *light schistose oil.* This light oil is decomposed into new products still more volatile, and passes with the gas into a refrigerator, which, by cooling down the products, causes some of them to reappear. The schistose oil is therefore not entirely gasified, but that which does not change into gaseous matter is preserved uninjured. What is very singular is that the links of the chain in the tube are never covered with any carbonaceous deposit. Thus while the shistose oil is evidently decomposed by heat during this operation, its decomposition is modified in a successful manner by its diffusion amid a large volume of gas, such as that produced from the decomposition of water, and which serves as a vehicle.

From the third tube is produced hydrogen and oxide of carbon, derived from the decomposition of the water, and the gases or vapours from the decomposition of the oil. By passing into the apparatus 20 gallons of water, and 25 of schistose oil, 50,000 gallons of gas fit for illumination are produced in twenty hours. The gas so produced requires no farther purification, having passed through a refrigerator where are deposited the nondecomposed oil, and steam from the water. From the refrigerator the gas passes into the gasometer.

M. Selligue's process and apparatus are represented as being so simple, as to be easily used in factories and private establishments, while the price of the gas so produced is low enough to be employed for lighting the streets. It has been proved by experiment not to deteriorate, but to improve at a distance from the gasometer; at five miles distance the flame was purer than when just issuing from the gasometer. When cooled down to 13°F. below zero, its illuminating power was not sensibly diminished. The gas is also free from sulphuretted compounds, and gives no unpleasant smell. The odour of coal gas, we may observe, however, is attributed by some chemists to vapour of naptha, and not to sulphur solely. As it does not act upon

metallic reflectors, M. Selligue is able to use these additions with great advantage, so much indeed that with a parabolic reflector one of his burners enables a middling size print to be read 80 yards off.

M. Selligue has set up gas apparatus at the Royal Printing House, and the Batignolles at Paris; at Dijon, and other cities, all of which work well.

We may observe that this process is on similar principles to that of the air light, in which air was decomposed and the oxygen burned with oily or bituminous matters, and in this case water is decomposed and the hydrogen similarly combined. Civ. Eng. & Arch. Jour.

Important Discovery in Metallurgy.

At a recent sitting of the *Academie des Sciences*, M. Becquerel read a paper relating to a most important discovery, namely, the application of the electro-chemical power to the art of metallurgy, especially as regards gold, silver, copper, and lead.

After a few preliminary remarks, explaining the various services which this force can render to natural sciences, to arts and manufactures, the learned academician alluded in particular to the refining of the precious metals; and it will be seen in the course of this analysis the great advantage he has derived from the new methods introduced by him into different branches of industry.

It will also be gratifying to learn, that one of the poorest departments of France possesses a gold, silver, and lead mine, and that the happy results already obtained hold out a still more flattering prospect. The following is an analysis of the memoir presented by M. Becquerel:—

The experiments relative to the application of the electro-chemical power to refining *(metallurgie)* of silver, copper, and lead, without the aid of quicksilver, and with little or no fuel, have been continued by M. Becquerel with constant success: his operations were conducted upon a large scale, and embraced considerable quantities of ores derived from Europe, Asia, and America. The object of these researches was, in the first place, the immediate separation *(reduction)* of the metals one from the other, and especially of silver and of lead from galena; this operation was effected with so much rapidity, that at the preparatory foundry, in Paris, four pounds weight of silver can now be drawn off in the metallic state from silver ore in the space of six hours; secondly, the preparation which the ore is to undergo, so as to render each metal capable of being withdrawn by the electric current. This preparation varies according to the nature of the ore, presents no obstacle when the silver is in the metallic state, or in the nature of a sulphate, as usually occurs in Mexico and Peru, but it becomes more complicated when the silver is mixed with other substances; the use of a small quantity of combustible matter is then indispensible in order to effect the roasting at a low temperature.

Ores are generally found in great quantities in those countries, but are for the most part abandoned, owing to the want of sufficient fuel for effecting their amalgamation, or to their being found at too great a distance from the sea to transport them to Europe, unless at an enormous expense.

In Columbia, where large masses of gold and silver ore are found mixed with zinc, the richest are sometimes exported to Europe to be fused, whilst the poorest and those of a medium quality are either rejected altogether or used to so little advantage that the mining companies lose by them. Exer-

tions are now in progress for introducing the new methods, which are equally applicable to amalgamation and to the electro-chemical process.

The silver ores which are most difficult of amalgamation are those which contain a large portion of copper and arsenic. Ores of this description are found in considerable quantity, especially in Chili, where the inhabitants frequently offer them to Europeans, by whom they are sometimes taken for ballast for want of freight, and without any certainty of turning them to advantage.

The great difficulty was to be able to treat these substances in Europe so as to obtain, in separate portions, and at little expense, all the silver, copper, and arsenic they contained. This problem has just been solved in a satisfactory manner, and so as to ensure immense advantages to new speculators, who will no longer have to contend with the obstacles met with by their predecessors.

On inquiring into the causes of the delay experienced in working the mines in America, it will be seen that the principal ones arise from the high price of quicksilver, and the great difficulty of draining the water by which the mines are inundated. This is not the case in Asia, in the Russian possessions, which are rich in mineral productions, and yield larger profits from day to day in consequence of the introduction of the improvements lately adopted in Europe for reducing metallic ores. In the silver mines of Altaie the expenses for extracting the ore, process of reduction, and of the establishment, do not amount to a quarter of the rough produce, although the ore in general is of slight tenacity. These advantages are owing to the moderate price of labour, the abundant supply of combustible matter, and other substances required in the fusing, and which are not to be had in America, especially in Mexico and the Cordilleras.

The electro-chemical process can be easily applied to the ores at Altaie; however, in countries where sufficient fuel is at hand, and salt cannot be procured, the fusing operation will be always preferred, except in cases of complex ores, which often exercise the ingenuity of metallurgists.

There are but few silver mines worked in Russia. The only ones of importance are those of Altaie, Nertchinsk, and those of the Caucasus and the Ural; but the great source of mineral riches in that kingdom consists principally of the gold and platina dust (sands), the washing of which engrosses the chief attention of the Government. This process, though methodically conducted, is very imperfect, for a large quantity of the gold contained in the sand is lost; the proceeds, however, are considerable; during the last year no less than 12,200lbs. were obtained, upwards of 800,000*l.* value.

The argentiferous and auriferous galenæ which have been subjected to the electro-chemical process are perfectly fit for the extraction of gold and silver by washing. This method requires that the ores should be pulverized and roasted so as to separate the metal from the pyrites and other compounds which detain it. The silver and lead being removed, the ore thus reduced to about half its weight, can be washed with the greatest facility, and one man can wash several hundred pounds per day. This method was tried with the galena (very argentiferous) discovered a few years since at St. Santin Cantalés, in the department of Cantal, and which yielded not more than 2½ grains of gold in every 200lb. of ore, with 30 per cent. of lead. But, upon adopting the electro-chemical process, the same quantity of ore produced something more than three drachms of gold. From this important result it is supposed that the rocks in that part of the country are auriferous, as might also be inferred from the name of the place, Aurilac *(auri lacus.)*

Another great advantage of the electro-chemical method is, that it enables the metallurgist to separate those portions of ore which contain gold, silver, &c., from those which contain none.

M. Becquerel then alluded to the other uses to which electricity might be applied in the manufacuture of metals, especially in the art of gilding silver and copper, as also for taking impressions in copper of medals, bassi relievi, and engravings.

The learned academician concluded by observing that this new and highly important power was only in its infancy, and that it would be impossible to foresee the immense services it was likely to render to the arts. Ibid.

Great Steam Engine Factory.

In Fawcett & Co's Factory, at Liverpool, are the following engines now in hand at the works, and the three largest nearly completed:

1 pair of	540	horse power	for the	"President."
1 do.	420	do.		the "United States."
1 do.	450	do.		a French man-of-war steam frigate.
1 do.	300	do.		H. M. S. "Medina."
1 do.	30	do.		the "Calcutta Steam-tug."*
1 do.	45	do.		a Government tender.†
1 single engine of	60	-horse power,		for Australia.
1 do.	50	do.		for a French house.

The President's Engines.—These are the most remarkable for their size, and are really a stupendous piece of workmanship. They are already fixed up, and strike the visitor with astonishment. The castings, and all the workmanship, are of the first description, and the architectural design of the frame-work, and pillars, is highly ornamental, without any sacrifice to the requisite strength. As probably the most suitable to attain this desideratum, the Gothic style has been adopted. The massy clustered pillars are surmounted by the pointed and moulded arch to correspond. The diagonal stays and their open work are in keeping; and such is the height and imposing effect of the whole, that visiters generally remarked that it strikingly resembled a handsome Gothic chapel. The beams are beautiful castings, as are the cylinders, and both of immense size and weight. The polished iron and brass work is superb, and the whole furnishes a gratifying proof, at once, of the enterprise and ingenuity of the men of England. The following are some interesting statistics of this stupendous piece of machinery:

Diameter of cylinder, . . .	80 inches.
Stroke of engine, ...	7 feet 6 inches.
Weight of cylinders, . . .	11 tons.
Valve-cases, from	6 to $6\frac{1}{2}$ tons.
Beams (4 in number,) upwards of .	5 tons each.
Condensers, about . . .	10 tons.
Gothic pillars, four pairs, each . .	11 tons, 7 cwt.
Diagonal stays, four in number, each .	4 tons.
Main, or paddle shaft, . . .	9 tons.
Two eduction pipes, each . .	18 cwt.
Boilers, each	30 tons.
Bed-plates, (two,) each in one casting,	15 tons.

The whole engines and boilers, with the water, will weigh about 510 tons.

* Now building in India.

† To run, it is said, between Dover and Calais.

The hoisting-tackle used in setting up these engines is well worthy of notice. On the principal, or lower beams, of the roof, which are of extraordinary strength, railways are fixed, upon which are traversed scaffolds, railed round, and each carrying a powerful winch. On these scaffolds are also railways, at right angles with those on the beams, so that, by moving the scaffolds and the winches, any spot of the building may be attained directly perpendicular to the article to be hoisted, which, by other movements, can be lowered to any given site.

The Engines of the United States.—These are precisely similar in construction to those of the President, differing only in being a little smaller. No detailed notice of them is therefore required. The cylinders are $73\frac{1}{2}$ inches in diameter, and the power is the same as that of the Great Western—namely, 420. They are erected in the same shed, or building, containing those of the President, and have been equally admired.

Civ. Eng. and Arch. Jour.

Rolling and Compressing of Iron.

Our attention has been directed to a novel and clever invention, applicable to an important branch of our manufactures, in the rolling and compressing of iron, producing thereby what may fairly be termed the thread of machinery. The articles to which the process applies have hitherto been made at the place where the demand has arisen, and only according to the extent actually required, but from the vast and exclusive advantages possessed by this mode, a large concentrated demand must arise.

In the process of rolling iron, the inference, upon the first blush, would be that there is nothing new in the operation of passing iron through rollers; but in this instance there is, the patentee having accomplished that which some of our leading engineers have hitherto doubted to be possible, namely, the rolling of iron alternately round and square, or with any other form of angle upon the same bar. This is accomplished by cutting the rollers according to the form required, when the iron passing through them with great rapidity, to the extent of fifteen times in a minute, assumes with an unerring precision, the various forms required. A rapid stride is thus made in the economy of time and labour, as the iron thus produced is, as appertaining to machinery purposes, for, upon being cut into given lengths, for bolts, rivets, &c., you get the round shaft upon which to cut the thread, and that with the square shoulder, and nothing remains but to pass it through the ordeal of compression to form the head of any figure or dimension required.

The extensive and largely increasing manufacture of machinery will receive great advantages from the perfection and exactness so desirable in its construction, from the circumstance that the connecting thread, as it may be termed, being all formed by one eye, will be of that uniformity, equality, and strength, that perfection is attained, with a great saving of labour to the mechanic, who will consequently have little if any trouble in applying them to his various purposes.

In the compressing department, applicable to bolts and other articles too numerous to particularize, and which forms a second patent, the most important result is derived from the regular temperature of the iron during the operation. "To strike the iron while it is hot," is a maxim too well understood and appreciated to need further remark than this—that a perfect bolt is instantly formed by one heating of iron, whilst, during the ordinary operation, a large portion of the heat is lost, which has to be recovered

by a second or third application to the furnace, thereby destroying, in some degree, the toughness and natural quality of the article, whence unsoundness ensues.

When this invention comes fully before the public, there can be no doubt of its beneficial results, both to the proprietors and to the artisan generally, from the various uses to which it will be applicable, and the facility which it will give him in perfecting his operations, while, as in some other large manufacturing concerns, he will no longer be at the mercy of the operative for his supply. Railway Mag.

Experimental Researches into the Strength of Pillars of Cast Iron, and other materials. By EATON HODGKINSON, ESQ.

The author finds that in all long pillars of the same dimensions, the resistance to crushing by flexure is about three times greater when the ends of the pillars are flat, than when they are rounded. A long uniform cast-iron pillar, with its ends firmly fixed, whether by means of disks or otherwise, has the same power to resist breaking as a pillar of the same diameter, and half the length, with the ends rounded, or turned so that the force would pass through the axis. The strength of a pillar with one end round and the other flat, is the arithmetical mean between that of a pillar of the same dimensions with both ends round, and one with both ends flat. Some additional strength is given to a pillar by enlarging its diameter in the middle part.

The author next investigated the strength of long cast-iron pillars with relation to their diameter and length. He concludes that the index of the power of the diameter, to which the strength is proportional, is 3.736. He then proceeds to determine, by a comparison of experimental results, the inverse power of the length to which the strength of the pillar is proportional. The highest value of this power is 1.914, the lowest, 1.537, the mean of all the comparisons, 1.7117. He thus deduces, first, approximate empirical formulæ for the breaking weight of solid pillars, and then proceeds to deduce more correct methods of determining their strength.

Experiments on hollow pillars of cast-iron are then described, and formulæ representing the strength of such pillars are deduced from these experiments.

After giving some results of experiments still in progress for determining the power of cast-iron pillars to resist long-continued pressure, the author proceeds to determine, from his experiments, the strength of pillars of wrought-iron and timber, as dependent on their dimensions. The conclusion for wrought-iron is, that the strength varies inversely as the square of the pillar's length, and directly as the power 3.75 of its diameter, the latter being nearly indentical with the result obtained for cast-iron; for timber, the strength varies nearly as the fourth power of the side of the square forming the section of the pillar. Experiments for determining the relation of the strength to the length in pillars of timber, were not instituted, as, from the great flexure of the material, it was considered that no very satisfactory conclusions on this point could be derived experimentally.

L. & E. Philos. Mag.

A Mode of Bending Disks of Silvered Plate Glass into Concave or Convex Mirrors by means of the pressure of the Atmosphere. By Mr. James Nasmyth.

The difficulty of obtaining large specula for telescopes, together with the disadvantages attending the weight, the brittleness, and liability to oxidation, of the speculum metal generally used, induced Mr. Nasmyth to turn his attention to the employment of silvered plate glass for telescopic purposes, as it possesses perfect truth of surface, is lighter than metal, is not liable to oxidation, and a greater quantity of light is reflected from it than from any metallic surface.

To give a concave or convex form to a disk of plate glass, a certain pressure must be made to act equally over the surface. This equal pressure is obtained on Mr. Nasmyth's plan, by taking advantage of the weight of the atmosphere.

A disk of silvered plate glass, 39 inches in diameter and $\frac{3}{16}$ths of an inch in thickness, is fitted and cemented into a shallow cast-iron dish, turned true on its face so as to render the chamber behind the glass perfectly air tight; by means of a tube communicating with this chamber, any portion of air can be withdrawn or injected.

To produce a concave mirror so slight a power is required, that on applying the mouth to the tube and exhausting the chamber, the weight of the atmosphere, which amounts in this case to 3558lbs., acting with equal pressure over a surface of 1186 square inches, causes the glass to assume a concavity of nearly three-quarters of an inch, which, in a diameter of 39 inches, is far beyond what would ever be required for telescopic purposes. On re-admitting the air, the glass immediately recovers its plane surface, and on forcing in air with the power of the lungs, it assumes a degree of convexity nearly equal to its former concavity. The degree of concavity or convexity may be regulated to the greatest nicety, and it is proposed to render the degree of concavity constant by placing in the air-tight chamber a disk of iron turned to the required form, and allowing the pressure of the atmosphere to retain the glass in the form given to it by its close contact with the iron disk.

The curve naturally taken by the glass when under the pressure of the atmosphere is believed by Mr. Nasmyth to be the catenary, inasmuch as its section would be the same as that of a line suspended from each end, and loaded equally throughout its length.—*Trans. Inst. Civ. Eng.*

Mech. Mag.

Important Application of Electricity.

At a recent meeting of the Academy of Sciences at Paris, the following description was given by M. Becquerel, of an interesting voltaic experiment performed by himself, which exhibits in a striking manner how the intensity of electrical power is accumulated by the current passing through wires twisted spirally. A platinum wire placed in communication with the two poles of a voltaic battery, becomes red-hot in a portion of its length. If that be twisted round spirally, all the heat is then concentrated in the interior of the convolutions. If a very small crucible be placed within the folds of the wire, the greatest conceivable effects of fusion are produced, even the platinum itself may be melted. The eye can scarcely bear the intensity of the light; the assays of ores of gold and silver, in quantities consisting of

several decigrammes, are effected in two or three minutes, and the combustion of diamond is produced in a few seconds. If, in order to prevent external radiation, the spiral wire be placed in the flame of a spirit lamp, the intensity of the incandescence is increased. The spiral may be put under the bell-glass receiver of an air pump, into which any gas may be introduced, and the fusion by this means be effected in gases, in a manner more satisfactory than chemists have hitherto been able to accomplish.

M. Becquerel has also made a skilful application of the power of electricity in the investigation of the influence of masses in the phenomena depending on affinities (a question that occupied much of the attention of philosophers at the beginning of the present century,) and in measuring the degree of those affinities in different circumstances. "In one combination consisting of two atoms," he observes, "the two atoms are united together by a force called affinity, the nature of which is unknown to us, and which varies in intensity according to the temperature, and to different other physical causes. But if we were enabled by means of some instrument of excessive delicacy to seize hold of each of the atoms, and to withdraw them by a contrary force from their reciprocal attractions, the force employed to effect this separation might be regarded as the measure of the attractive force. In default of this ideal apparatus, we possess in electricity a power capable of doing the same thing. It appears from numerous experiments, with the aid of electrical action, that when two salts united with the same acid are dissolved in water, we possess the means of determining with accuracy the strength of the affinity of the acid for each of the two bases, and of following, step by step, the variation in this degree, of affinity, according to the change in that of the saline bases." Mining Review.

Gilding of Metals by Electro-Chemical Action.

M. de la Rive has succeeded in gilding metals by means of this powerful action; his method is as follows:—He pours a solution of chloride of gold (obtained by dissolving gold in a mixture of nitric and muriatic acid), as neutral as possible, and very dilute, into a cylindrical bag made of bladder; he then plunges the bag into a glass vessel containing very slightly acidulated water; the metal to be gilded is immersed in the solution of gold, and communicates by means of metallic wire with a plate of zinc, which is placed in the acidulated water. The process may be varied, if the operator pleases, by placing the acidulated water and zinc in the bag, and the solution of gold with the metal to be gilded in the glass vessel. In the course of about a minute, the metal may be withdrawn, and wiped with a piece of linen; when rubbed briskly with the cloth, it will be found to be slightly gilded. After two or three similar immersions, the gilding will be sufficiently thick to enable the operator to terminate the process. Ibid.

A Newly Invented Planing Machine.

On visiting the Polytechnic Exhibition, Newcastle, a few days ago, we were much amused at witnessing the operations of what appeared to be a little model of a planing machine on a new plan, and we followed its backward and forward motion with a great deal of interest; when, after a very short space of time, we were not a little surprised at the precision and the quantity of work performed; and we discovered by a brass plate, that, instead

of being merely a model, it was, in fact, a new working planing machine, recently introduced into the mechanical workshop by a Mr. John Roberts, of Manchester. It is so simple in its construction, and so portable in its dimensions, that it may be laid on the vice-bench, and set to work either by a motion from a steam engine or by hand, and so useful that one man with it can do the work of three men at the vice. The principal novelties in the invention are—the tool, which cuts both ways—and the extreme facility with which anything to be planed may be fixed in the machine. It may very appropriately be termed a self-acting mechanic, and does credit to the mechanical talents of the ingenious inventor, Mr. Roberts.—*Port of Tyne Pilot.* Mech. Mag.

Progress of Civil Engineering.

Resistance of Air to Railway Trains. *By* Dr. Lardner.

[continued from page 283.]

As a second test, the engine and tender were now placed in front of four coaches, so as to form a regular train, and it was allowed to descend the plane in the same manner. The engine and tender was then removed, and replaced by two coaches of equal weight, and the train of six coaches was then allowed to descend the plane in the same way. The result of the experiment is exhibited in the following table:—

	Weight.	Total distance run.	Time of running total distance.		Greatest speed.	Total of descending the Sutton plane. 1.89	
	Tons.	Yards.	m.	s	m. p. h.	m.	s.
Fury, Tender, & four coaches	27.45	5.068	12	9	30.5	4	33
Six coaches	27.45	4.850	10	48	31.	4	28
Difference		.218	1	21		0	5

It is needless to enlarge upon these results. The plain and inevitable inference is, and that inference would be further corroborated by what he had still to explain,—that the form of the front, whether flat or sharp, has no observable effect on the resistance; and that whether the engine and tender be in front, or two carriages of the same weight as the engine and tender, the motion of the train, and the resistance to its motion, will be exactly the same.

The form of a boat, or beak, having been given to some of the engines on the Great Western Railway, apparently with a view to diminish the effect of the atmospheric resistance, Dr. Lardner determined to ascertain how far such a form would produce any practical effect. He accordingly constructed a head or a beak, to place before the first carriage of a train. Two boards were constructed equal in height to the body of the carriage, and being attached to each corner, were united in front at an angle, the vertex of the angle being five feet six inches before the flat front of the carriage, and the base of the angle being six feet six inches, corresponding with the width of the carriage. This apparatus would have the effect of a cut-air. It was first tried with a single coach, which, having it attached in front, was moved

as before down the Sutton plane, and the circumstances of the motion having been observed and recorded, the beak was removed, and the coach again moved down with the flat end exposed to the air. The result was as follows:—

	Weight.	Total distance run.	Time of running total distance.	Greatest speed.	Total of descending the Sutton plane, 1.89.
	Tons.	Yards.	m. s.	m. p. h.	m. s.
Coach with pointed front	5.35	3.975	11 0	24.3	5 35
Coach with flat front	5.35	3.905	11 0	23.7	4 45
Difference		70			0 50

It is evident that no effect whatever was produced by the beak, and, consequently, the flat end of the coach produced none of that resistance which Mr. Brunel ascribed to it. The same experiment was now repeated with a train of eight coaches, down the series of inclined planes at Madeley. The beak being placed upon the first coach, the train was started from the summit of the Madeley plane, falling $\frac{1}{177}$, and it was dismissed down the series of planes already described, the circumstances of its motion being carefully observed. It was then brought back to the top of the Madeley plane, and the beak removed, and was once more dismissed, the circumstances being again observed. The following are the particulars of this experiment:—

	Weight.	Total distance run.	Time of running total distance.	Initial speed.	Uniform speed on 1.177.	Speed at foot of 1.265.	Speed at foot of 1.330.	Time of moving down 1.177.	Time of moving down 1.265.	Time of moving down 1.330.
	Tons.	Yards.	m. s.	m. p. h.	m. p. h.	m. p. h.	m. p. h.	m. s.	m. s.	m. s.
Eight coaches with pointed end foremost	40.75	14.411	26 48	23.70	24.	19.25	14.87	8 41	8 50	4 50
Same train, with flat end foremost	40.75	14.331	25 39	23.37	26.18	19.25	14.35	7 53	9 32	4 57
Difference		80	1 9	.33	2.18		.52	0 48	0 42	0 7

It appears, therefore, that the distance run without the sharp end differed only eighty yards in a distance of about eight miles; and the other differences exhibited in the table, are evidently such only as would take place with the same experiment twice repeated with the same carriages.

With a view to ascertain how far mere magnitude of frontage, independent of the general magnitude of the train, is productive of resistance, the front of a coach was enlarged by side boards, extending on either side about twenty inches, adding about twenty-four square feet to the front surface, forming a sort of wings in front of the carriage, but no corresponding width being given to any other part of the carriage. The coach, thus prepared, was placed at the summit of the Sutton plane, and allowed to descend from

a state of rest. It was then brought once more to the summit, and the sides removed, and it was allowed to descend with its proper front. The result of these two experiments is exhibited in the following table:—

	Weight.	Total distance run.	Time of running total distance.		Greatest speed.	Total of descending the Sutton plane, 1.89.	
	Tons.	Yards.	m.	s.	m. p. h.	m.	s.
Coach with enlarged front	5.35	3.139	9	10	19.15	5	31
Coach with ordinary front	5.35	3.289	9	2	21.45	4	15
Difference		150	0	8	2.30	1	16

From which it was inferred, that mere width of frontage, apart from the general increase of magnitute, was not productive of any considerable practical effect in increasing the resistance.

A strong impression existed in the minds of some engineers and scientific men, to whom Dr. Lardner communicated the results of these experiments while they were in progress, that the shape of the hinder part of the train might have an effect upon the resistance. It was supposed that in very rapid motion a tendency to a vacuum would be produced behind the train, and that a corresponding atmospheric resistance, due to this partial vacuum, would be produced in front; that, consequently, if the square shape was removed from the hinder part, less resistance would be found. Although Dr. Lardner did not attach any weight to this objection, he was willing, nevertheless, to submit it to trial, and with that view he prepared a train of three carriages, which he first placed at the summit of the Sutton plane, falling $\frac{1}{89}$, and allowed them to descend by gravity in their ordinary state. He next allowed them to descend, having the pointed end behind; they next descended with the pointed end before; and, lastly, they were once more allowed to descend without the pointed end. The result of these four experiments is given in the following table:—

	Weight.	Total distance run.	Time of running total distance.		Greatest speed.	Time of moving down Sutton plane 1.89.		Time of moving $2\frac{1}{2}$ miles.		Time from stake 12 to stake 28.	
	Tons.	Yards.	m.	s.	m. p. h.	m.	s.	m.	s.	m.	s.
Four coaches, with flat front and end	14.8	5,209	13	50	32.14	4	28	7	54	2	9
Same, with pointed end	14.8	5,350	13	45	31.03	4	25	7	50	2	9
Same, with pointed front	14.8	5,576	13	1	32.14	4	23	7	30	2	5
Same, with flat front and end	14.8	5,518	13	25	32.14	4	22	7	32	2	6

In the third column is expressed the entire distance run, in yards; in the

fourth column is the time of going that distance; in the fifth column is the speed acquired in descending the Sutton plane; in the sixth column the time of descending that plane; in the seventh column the time of moving a distance of $2\frac{1}{2}$ miles from the time of starting; and, in the last column, the time of moving from the twelfth to the twenty-eighth stake, throughout which, the motion being tolerably rapid, the effect of the air might be expected to be greatest. It will be evident, from this table, that the pointed end, whether before or behind, was not attended with any appreciable effect, the discrepancies being only such as would occur in the same experiment twice repeated.

It had been suggested that the resistance opposed by the air might be more or less produced by the spaces between the successive carriages of the train, the end of each successive carriage being more or less exposed to pressure against the air. In order to ascertain what weight this suggestion was entitled to, a train of eight carriages was prepared, having tenter hooks attached round the corners of their ends. Canvas was prepared, which, being hooked on these, might be stretched from carriage to carriage, so as entirely to enclose the space between the successive carriages, and to convert the whole train into one unbroken prism. The train being thus prepared with the canvas, was brought to the summit of the Madeley plane, and allowed to descend towards Crewe, the circumstances of the motion being observed as in the former experiments. It was then again removed to the summit, and, the canvas being taken off, the train was allowed to descend in its ordinary state, the spaces between the carriages being left open. The result of these two experiments is exhibited in the following table; and it will be seen that the differences are nothing more than what would arise from casual causes affecting the same experiment twice repeated:—

	Weight.	Total distance run.	Time of running total distance.	Initial speed.	Uniform speed on 1.177.	Speed at foot of 1.265.	Speed at foot of 1.330.	Time of moving down 1.177.	Time of moving down 1.265.	Time of moving down 1.330.
	Tons,	Yards.	m. s.	m. p. h.	m. p. h.	m. p. h.	m. p. h.	m. s.	m. s.	m. s.
Eight coaches with canvas	40.75	14,367	25 39	26.39	25.57	18.	12.4	8 2	8 47	5 31
Same without canvas	40.75	14,731	25 39	23.37	26.18	19.25	14.35	7 53	8 32	4 57
Difference		364.		3.2		1.25	2.31	0 9	0 15	0 34

Being impressed with the idea that the amount of resistance might be more or less dependent on the general volume of air displaced by the train as it moves, rather than by the mere magnitude of frontage, an experiment was made which was attended with a result sufficiently remarkable. A train of five wagons was prepared, weighing exactly 30 tons, and loaded with iron rails: sides and ends were constructed, which, being put up, these wagons received the form of coaches, but which, being movable, could be put up or laid flat upon the wagons at pleasure. This train of wagons was brought to the summit of the Madeley plane, and allowed to descend, by gravity, towards Crewe, the circumstances of its motion being observed, as before. It was then brought back to the summit of the same plane, and the sides were taken down and laid flat upon the wagons, and it was then moved

down the plane. The particulars of these two experiments are exhibited in the following table:—

	Weight.	Frontage.	Total distance run.	Time of running total distance.	Uniform velocity on 1.177.	Velocity at foot of 1.265.	Time of moving down 1.177.	Time of moving down 1.265.
	Tons.	sq. ft.	Yards.	m. s.			m. s.	m. s.
Five wagons, with high sides	30	24.	14,058	34 55	22.75	19.50	18 51	6 55
Same, without high sides	30	47.8	10,019	32 4	17.	8.50	15 44	9 47
Difference		23.8	4,039	2 51	5.75	11.	3 7	2 5[illegible]

The effect of the form of the wagons upon the resistance is here sufficientl manifest, and the concurrent circumstances upon the several gradients plai ly show the increased resistance produced by the increased magnitude the train. From this and the former experiments, it may therefore be i ferred that the mere form, whether of the front or hinder part, or the me magnitude of frontage, produces no practical effects upon resistance; that, by increasing not the frontage only, but the *whole volume* of the tr a material effect is produced.

It had been found, contrary to what was at first expected, that by incr ing the number of carriages in the train, that portion of the resistance w must be ascribed to the atmosphere was increased. It appeared, at first v that the chief, if not the only source of atmospheric resistance was t found in the frontage or maximum transverse section. The experiments, ever, are entirely incompatible with any such supposition. Had suc the case, the trains of six and eight carriages ought to have acquired siderably greater velocity in descending the inclined planes, than the of four carriages, which was not the case. This is in some degree ac ed for by the result of the last experiment indicating the connexion be the volume of air displaced and the resistance, and not between the frontage and the resistance. But, in addition to this, there is anothe cumstance, which was pointed out by Dr. Lardner long since. The w of the several carriges produce a vortex of air around them, and p some measure the part of fanners or blowers. A considerable force m absorbed by so great a number of these wheels moving at such a ve In a train of eight carriages we have thirty-two three-feet wheels, p these parts of blowers, and revolving from four to five times in a second. much force must be expended in maintaining such a motion, it is ne to say. But, besides this, another circumstance was observed. In experiments, as well as in general railway practice, it is found that a tensive current of air moves beside a train, the current diminishing in v ty as the distance from the train increases. Immediately contiguous side of the coaches the air moves with little less velocity than the co themselves. Outside that is another current, moving at a less rate, a yond that another at a further diminished rate. There is, thus, a succ of currents, one outside another, extending to a considerable distan each side of the train. All the resistance produced by the motion of mass of air through the atmosphere, forms part of the resistance oppose the moving power.

In all the experiments which were made on the series of planes between Madeley and Crewe, it was found that in moving over these parts of the line which were curved, the uniform velocity was precisely the same as on those parts which were straight. There was no discoverable difference in the rate of motion, from whence it follows that curves like these, having a radius of a mile, produce no observable effect upon the resistance. The experiments were so numerous, and performed under such a variety of circumstances, that, unexpected as these results were, there can be no doubt of their truth.

It has been stated confidently in print and at public meetings, by men reputed to possess information in practical science, that the atmospheric resistance has been long known, not perhaps with perfect accuracy, but that tables, giving a near approximation, have been published by different eminent men, and are to be found in most elementary works; that calculations, founded on these tables, of the resistance of the atmosphere may be made, and that such calculations would give more correct results than such experiments as have been now described. As such statements are calculated to mislead, Dr. Lardner had no hesitation in declaring that they are utterly unfounded. No details exist, nor have any experiments ever been made by which the resistance of the air to a train of railway carriages could be obtained by any calculation whatever; nor was the amount of such resistance ever suspected, even by the persons who have ventured to utter such statements, as have been here proved to exist.

Having been satisfied of the large amount of the resistance of railway trains at the usual speed of passenger trains, the next inquiry was one of a still more difficult kind, namely, to obtain, by reducing the results of the experiments to mathematical analysis, an estimate of the quantity of this resistance which was due to friction and to the atmosphere respectively. The details of this investigation are not of a nature to introduce into a journal like the *Athenæum*. A part of them, however, may be seen by reference to the volume of the Transactions of the British Association, lately published, and the remainder will appear in Dr. Lardner's second Report. In the meanwhile we may state the results, from which it would appear, that as considerable an error has been committed in overrating the amount of resistance due to friction, as in underrating the whole resistance. The formulæ, established by Dr. Lardner, have been applied to a limited number of experiments performed under different circumstances, and the results agree in giving the friction a value amounting to from five to six pounds a ton, of the gross weight. How widely this differs from the common estimate may be perceived when it is stated, that that estimate is from nine to eleven pounds per ton. Mr. Woods, the engineer of the Liverpool and Manchester railway, has applied a method of calculation to one of M. de Pambour's experiments, by which the resistance from friction is obtained very nearly free from the effect of atmospheric resistance, but it is not the method used by Dr. Lardner. The result obtained by Mr. Woods is the same as that obtained by Dr. Lardner.

Dr. Lardner read at the meeting a communication from M. de Pambour, stating, that that gentleman had been engaged in similar inquiries, as to the amount of the friction and the atmospheric resistance, with a view to correct, in the forthcoming edition of his work on Locomotive Engines, any errors which might have existed in the former edition, and the results which M. de Pambour stated that he obtained from the friction, were the same as those obtained by Dr. Lardner and Mr. Woods.

Dr. Lardner proceeded to say, that the results of this extensive course of experiments corroborated and fully established a doctrine which he had ventured to advance before a committee of the House of Lords in the year 1835, but which was then and subsequently pronounced to be paradoxical, absurd, and one which could have no practical truth. That doctrine was, that a railway laid down with gradients, from sixteen to twenty-five feet a mile, would be, for all practical purposes, nearly, if not altogether, as good as a railway laid down, from terminus to terminus, upon a dead level. The grounds on which he advanced this doctrine were, that a compensating effect would be produced in descending and ascending the gradients, and that a variation of speed in the train would be the whole amount of inconvenience which would ensue; that the time of performing the journey, and the expenditure of power required for it, the expense of maintaining the line of way, and supplying locomotive power. would be the same in both cases; that, therefore, he thought that no considerable capital ought to be expended in obtaining gradients lower than those just mentioned. He stated that he was assailed with the most unsparing ridicule when he advanced this doctrine, and that up to the present hour, so far as he knew, it had never been adopted or assented to by any practical man in the country. He saw, however, its complete verification and establishment in the results of these experiments, and determined on making an *experimentum crucis*, which should put its truth beyond all question. The variety of gradients on the railway extending between Liverpool and Birmingham, offered a favourable theatre for such an experiment, and accordingly a train of twelve coaches was prepared, each coach being loaded to the gross weight of five tons. An engine, called the *Hecla*, was provided, weighing twelve tons, with her tender weighing ten tons, making a gross load of eighty-two tons. It was determined to run this train from Liverpool to Birmingham and back, observing, with the utmost precision, the moment of passing each quarter-mile post, and obtaining thereby the actual speed with which every gradient, from one end to the other of the line, was ascended and descended, and the velocity on the levels. By taking a mean of the speed in ascending and descending the gradients, it would be necessary, if the doctrine held by him had any truth in it, that this mean should be exactly, or very nearly, equal to the speed on a level. The journey was accordingly performed, and the results of it will be published in detail in Dr. Lardner's second Report. But, in the meanwhile, the speed, in ascending and descending the several gradients and the mean between them, is exhibited in the following table:—

Gradient.	Speed.		Mean.
	Ascending.	Descending.	
one in	mile per h.	mile per h.	
177	22.25	41.32	31.78
265	24.87	39 13	32.00
330	25.26	37.07	31.16
400	26.87	36.75	31.81
532	27.35	34.30	30.82
590	27.27	33.16	30.21
650	29.03	32.58	30.80
Level	.	. .	30.93

He said, that on this table it is scarcely needful to make a single observation. It is quite evident, that the gradients do possess the compensating power which he ascribed to them. The discrepancy existing among the mean values of the speed, is nothing more than what may be ascribed to casual variations in the moving power. This experiment also was made under very favourable circumstances, the day being quite calm. Without going into the details of the principle on which these remarkable results depend, it may be stated generally, that since the chief part of the resistance of a railway train depends on the atmosphere, and is proportional to the square of the velocity, a very small diminution in the velocity itself produces a considerable diminution in its square. A train, in ascending a gradient, may therefore relieve itself from as much atmospheric resistance as is equal to the gravitation of the plane by slackening its speed. If its speed be slackened so as to render the resistance equal to that which it would have upon a level, then the engine would have to work with a less evaporating power than on a level, inasmuch as the motion would be slower. In practice, therefore, it can never be needful to slacken the speed so much as to equalize the resistance with that upon the level. Supposing the evaporating power to remain the same, the speed need only be slackened, so that with the same evaporation an increased resistance can be overcome at a speed less than the level, but not so much less as would render the resistance equal to the level. This, in fact, is what takes place in practice, as is apparent from the results above given.

Dr. Lardner concluded by stating in detail a number of conclusions which he considered to be warranted by the experiments; but he reserved to himself the power, when the experiments should be all reduced, of modifying these conclusions, if it should appear necessary to do so. He stated that many of the experiments had been only recently made, and had consequently not been submitted to mathematical analysis. Meanwhile he had taken care to lay nothing before the Section, except what had been fully borne out by the experiments themselves. He regarded the following conclusions as established by his experiments:—

1. That the resistance to a railway train, other things being the same, depends on the speed.

2. That at the same speed the resistance will be in the ratio of the load, if the carriages remain unaltered.

3. That if the number of carriages be increased the resistance is increased, but not in so great a ratio as the load.

4. That, therefore, the resistance does not, as has been hitherto supposed, bear an invariable ratio to the load, and *ought not to be expressed at so much per ton.*

5. That the amount of the resistance of ordinary loads carried on railways at the ordinary speeds, more especially of passenger trains, is very much greater than engineers have hitherto supposed.

6. That a considerable, but not exactly ascertained proportion of this resistance is due to the air.

7. That the shape of the front or hind part of the train has no observable effect on the resistance.

8. That the spaces between the carriages of the train have no observable effect on the resistance.

9. That the train with the same width of front, suffers increased resistance with the increased bulk or volume of the coaches.

10. That mathematical formulæ, deduced from the supposition that the

resistance of railway trains consists of two parts, one proportional to the load, but independent of the speed, and the other proportional to the square of the speed, have been applied to a limited number of experiments, and have given results in very near accordance, but that the experiments must be farther multiplied and varied before safe, exact, and general conclusions can be drawn.

11. That the amount of resistance being so much greater than has been hitherto supposed, and the resistance produced by curves of a mile radius being inappreciable, railways laid down with gradients of from sixteen to twenty feet a mile have practically but little disadvantage compared with a dead level, and that curves may be safely made with radii less than a mile; but that further experiments must be made to determine a safe minor limit for the radii of such curves, this principle being understood to be limited in its application to railways intended chiefly for rapid traffic.

In the course of his address, Dr. Lardner took occasion to acknowledge the very valuable assistance which he had received from Mr. Edward Woods, the engineer of the Liverpool and Manchester Railway, who assisted Dr. Lardner in almost all the experiments, and conducted some of them himself in Dr. Lardner's absence. To the skill and intelligence of that gentleman, as well as to his general mathematical acquirements, he felt himself much indebted. Mr. H. Earle was also associated in these experiments, and took part in the direction of many of them.

[The preceding report is necessarily much condensed, but may be relied upon as correct in all essential points. The speech of Dr. Lardner took nearly four hours in the delivery.]

Mr. C. Vignolles, C. E., said that he had listened with considerable surprise to the very unexpected results of this elaborate course of experiments; and that having frequently, on former occasions, differed from his friend Dr. Lardner on many material points connected with railway practice, he felt bound to say, on this occasion, that the results which had been attained were most satisfactory, and that they would have a most important bearing on the laying out of railways. It was evident that they would tend to relieve the engineer from the trammels under which he now conceived himself, in most cases, placed, by being compelled to adopt a section at variance with the natural character of the country; that much capital would be saved in future lines, by the engineer not being compelled to incur the same expense as heretofore in excavations and embankments and other works, into the adoption of which he was driven by the supposed advantages of very low gradients. If it be true that gradients of sixteen and twenty feet a mile are practically equivalent to a dead level, it must be equally certain, that gradients of thirty feet a mile, or even more, had not disadvantages, and were not attended with objections, even approaching in importance to those which have been usually assigned to such inclinations. Had these principles been established sooner, much capital would have been saved by shareholders in some lines of railway in process of construction. Mr. Vignolles concluded by expressing the obligation which he was sure the engineering profession would feel to Dr. Lardner and the other gentlemen who carried out these experiments.

Mr. Scott Russell vindicated Dr. Lardner's claim to having been the first to establish the important agency of the atmosphere in resisting railway trains. He stated, that before these investigations were commenced there had been made no public statement, nor had there existed any public document by which any individual was known to have even entered on a similar

investigation; that the experiments which had been made on resistance of the air by Dr. Hutton and others, were altogether inapplicable to such bodies as railway trains moving at such speeds; that Dr. Hutton himself, who had examined the question of the resistance of the air more carefully than those who went before him, admitted, that his own experiments proved nothing except our entire ignorance of either the amount or the law of atmospheric resistance, and that it was only from carefully and well conducted experiments that any such knowledge could be expected; he therefore hoped that these experiments would be the commencement of an inquiry which would terminate in a more enlarged and correct knowledge of atmospheric resistance in general.

Athenæum.

Report from Major H. Bache on the Brandywine Light-house.

Office of the Brandywine Light-house,
Philadelphia, November 1, 1839.

Sir: The following report of the Brandywine light-house for the past season, made in compliance with the general regulations of the bureau, is respectfully submitted:

The operations have, in consequence of the failure of Congress to make the additional appropriation called for last session, been limited to such expenditures as could be covered by the balances of former years, and, from the insufficiency of these, were confined to measures preliminary to taking position at the site of the work. Among the most important of these are the building of the caisson, by means of which it is proposed to establish the foundation, and the preparation of the foundation stone. The caisson, with unimportant exceptions, was completed some months since. It is elliptical in form, about fifty feet in length by forty feet in width, and twenty-five feet high, constructed entirely of white oak, thoroughly iron-fastened, and in all respects a substantial vessel, capable, it is believed, of resisting the shock to which it will be exposed, and fully equal in other respects to fulfil the objects for which it was designed. It is still on the stocks, where, protected by a roof from the weather, it will remain until required for use. The stone for the foundation, or the foundation rock, as it may very properly be called, is now preparing under the contract of the 9th of January last. Two courses are finished, and two more are in a state of considerable forwardness, and will, with the remaining courses, be ready before the opening of the coming season of operations. The foundation rock is $42\frac{1}{2}$ feet long by $31\frac{1}{2}$ feet broad, and 20 feet high. It is formed of 671 blocks of rough-hammered stone, disposed in ten courses. Of these blocks, 372 weigh each three tons, and are regular and alike in form; and 299 weigh each from one to three tons, and are irregular and unlike. A single course weighs 161.33 tons, and the entire foundation rock, 1,613.3 tons. Each course, as finished, is laid dry at the quarries, where the necessary platforms and cranes are provided, to prevent the delays in building, arising from errors in working the stone, which might prove fatal to the success of the work. The brick pavement bond is the one adopted for the foundation rock; the joints of each course lying at angles of 45 degrees with those of the courses adjacent, in order to resist, in the most effectual manner, the disposition which the mass, from unequal subsidence or other cause, might have to fall or break off. To give still greater security against this tendency, copper dowels and cramps will be used to bind the whole together. Of the latter, nearly 1,700 will be employed.

The original design for this work contemplated a foundation, built on a mole of breakwater stone from the level of low water. The objections to this mode of construction were stated in a communication addressed to the bureau on the 14th of July, 1837, in which, for reasons then given, it was recommended to establish the foundation by means of a caisson. Further reflection has served to confirm these views. Fears were entertained that, by the plan first proposed, the superstructure, being built upon breakwater stone thrown at random on the bottom, would, by unequal settling, be liable to fracture; and it was doubted whether heavy masses of masonry, raised upon such a base, ever proved entirely satisfactory. It was also urged that, as the masonry, until it reached high-water, would necessarily have to be carried on at short intervals of time, and under very great disadvantages at so exposed a position, the cost of construction would thereby be very much increased. These objections are obviated by the use of the caisson, as the work may be carried on at any stage of the tide, and the masonry built from the bottom, saving the thickness of the caisson, which it is presumed will settle in the sand; thus affording a reasonable expectation that the subsidence will be equal, and the superstructure secured from liability to fracture. It will be remarked that the employment of the caisson does not necessarily constitute a modification of the first design, but rather furnishes a means by which that design may be securely carried out. It would fail, however, to yield all the advantages which belong to such a mode of construction, were the foundation not to receive, under the facilities afforded, a more perfect and stable character. It has, therefore, been deemed proper to substitute for this part of the work masonry of wrought stone, instead of the rubble masonry resting on breakwater stone, as was proposed in the first instance. These changes involve, upon the whole, a considerable increase in the cost of the work; an increase, however, which is fully justified by the additional security afforded of prosecuting the operations to a successful termination, and by the greater stability that will be given to the work itself. This increase, as well as that arising from advance in prices since the date of the first estimate, will be indicated under the proper heads. The most prominent among the latter, is in the cost of breakwater stone, advanced 20 and 11 per cent. respectively for the two sizes, and which is now set down at the contract price of the present season for the Delaware breakwater. It will also be seen that the contingencies have been raised to 17 per cent., as that has been the average, nearly, for several years at the above work, and there is no reason to suppose they would be less for the Brandywine lighthouse.

The following statements will show the increase which the proposed modifications and the advance in prices will cause in the cost of the work:

The original estimate for the space which will now be occupied by the foundation, established by means of the caisson, was as follows:

41 tons of breakwater stone, of pieces of two tons and upward, at $2 50 per ton, ...	$102 50
1,436 tons of breakwater stone, of pieces of ¼ to 2 tons, at $1 80 per ton, ...	2,584 80
340 cubic yards of heavy building stone, at $5 20 per cubic yard, ...	$1,768 00
Laying the same, including all expenses, at $17 20 per cubic yard, ...	5,848 00
	10,303 30

Contingencies, 15 per cent., ...	1,545 50
Total amount by original estimate, . .	11,848 80
The revised estimate, by the modified plan, for establishing the foundation by means of a caisson, and under the advance in prices, is as follows: caisson, ...	$11,011 63
962 cubic yards of rough-hammered stone, including lewis-holes and cramp-holes, and channels, at $22 95 per cubic yard, ...	22,077 90
Laying the same, including all expenses, at $8 60 per cubic yard, ...	8,273 20
2,092 copper cramps, at $1 25 each, . . .	2,615 00
	43,977 73
Contingencies, 17 per cent., . . .	7,476 21
Total amount of revised estimate by modified plan, &c., .	51,453 94
Total amount of original estimate, . . .	11,848 80
Total amount of increase, ...	39,605 14

How much of this increase is fairly attributable to the new plan, and how much to the advance in prices and increase for contingencies, it is not easy to determine. If, however, the average prices now paid for breakwater stone be taken as a criterion, more than $8,000 is properly assignable to the latter causes.

The exposed situation of the Brandywine shoal, lying as it does in the widest part of the bay, and within eight miles of the ocean, renders it absolutely necessary that the protecting work be formed at once on bringing the caisson in position; as on the one hand, were the foundation constructed and no protection provided, the action of the waves, in their recoil from the mass, by washing away the sand composing the shoal, would in a very short time undermine and destroy the work; so on the other, were the protecting work completed in the first instance, deposits of unequal density and irregular form would be induced, where now the bottom is singularly hard and flat. The removal of these deposits, and of any stone which from carelessness or design may have been thrown within the same space, would be attended with much labor and no inconsiderable expense, and, what is of much more importance in a work of this character, with a delay which might prove fatal to the undertaking. The two operations, indeed, should be carried on as nearly simultaneously as their very different characters will permit, and, to be secure against the ice and storms of the succeeding winter, be brought to a close in a single season. At so exposed a position as the Brandywine, this may be set down at barely three months, commencing with the 20th of May, a period certainly very limited to complete a work of the extent contemplated, considering the difficulties and vexations under which it must be prosecuted.

The following estimate for the next season is based upon the views just given. Admitting their soundness, the necessity of providing at once ample means to carry them out, need not be urged. The appropriation of a less amount would merely take from the Treasury a sum that could not be applied profitably to this work. It is also proper that the appropriation be available at least two months before the opening of the season, to afford time for making

the necessary contracts and arrangements; otherwise, all operations must be postponed until the following year.

Breakwater, which will form a part of the protecting mole.

11,711 tons of breakwater stone, of pieces of two tons and upward, at $3 per ton, . .	$35,133 00	
21,438 tons of breakwater stone, of pieces of ¼ to two tons, at $2 00 per ton, . .	42,876 00	
Cost of breakwater, ...		$78,009 00

Foundation to floor of cellar.

Caisson, ...	11,011 63	
775,24 cubic yards of rough-hammered stone, including lewis-holes and cramp-holes, and channels, at $22 95 per cubic pard, . .	17,791 75	
Laying the same, including all expenses, at $8 60 per cubic yard, ...	6,667 06	
1,686 copper cramps at $1 25 each, .	2,107 50	
Cost of foundation to floor of cellar, . .		37,577 94
		115,586 94
Contingencies, 17 per cent., ...		19,649 78
Total amount, . . .		135,236 72
Amount already appropriated, ...		45,000 00
Additional appropriation required for next season, . .		90,236 72

It is proposed to carry on the operations under the foregoing estimate, in the following manner:

The proper position for the light-house is at the point where a line drawn on the usual sailing course of vessels, proceeding up the bay, bisects the mouth of the channel between the Brandywine and Brown shoals, and strikes the former at the assumed depth. To determine this point, it will be necessary to lay down the lower half of the channel between the Brandywine and Brown, including the seaward points of those shoals, and the western side of the former, with their relation to the meridian and the shore. This operation will consist, in the first instance, in fixing the position of not less than four permanent stations, well selected on the above-named shoals, from which the detailed hydrography, so essential to a correct determination of the point in question, will be carried on. These permanent stations will, each, consist of a single tripod of timber, 35 to 40 feet in height, properly strutted out and weighted at the foot, with a fourth spar rising from the apex, and surmounted by the usual tin cone to ensure its being seen distinctly from the shore. To one or more of these will be attached the tide registers, necessary to a correct reduction of the soundings to any given plane. Of the permanency of these tripods under all circumstances, except against ice and the worm, no doubt is entertained.

The next operation in order is to mark out the site with piles, to guide in placing the caisson and depositing the stone which will surround it. The small number of these piles will allow of their being driven in a few days,

by a pile engine placed on a platform, resting on timber tripods of the kind already described, but smaller in size. To ensure the completion of these operations in proper season, they should be commenced as early in the spring as the boisterous character of the locality will permit.

The placing of the caisson in position is an operation of great delicacy; and on giving, at once, the necessary protection to the bottom around it, depends the success of the work. It is in fact the turning point in the undertaking, and, in comparison with which, the subsequent risks and difficulties are of small moment. No means should, therefore, be neglected to ensure it against failure; and a shortsighted economy would prove fatal to it. These means have been the subject of much anxious reflection, and being predicated on the truth of the proposition that the soil composing the shoal is capable of sustaining the work, are all directed to the single object of retaining this soil in its natural position. In what manner it is proposed to effect this object will now be explained.

The caisson, provided with the necessary moorings and machinery for hoisting stone, having had laid on board as much of the foundation as will cause it to draw about 15 feet water, will be towed by one or more steamboats to some convenient harbour in the immediate neighbourhood of the Brandywine shoal. This point will likewise be the rendezvous for vessels carrying Breakwater stone, and that portion of the foundation coming next in order in the construction. Here the final arrangements will be made, and taking advantage of a settled state of the weather, the whole will move down to the scene of operations. The site, it will be remembered, has already been marked out. It will, also, be borne in mind, that the caisson is supposed to be loaded to a draught of fifteen feet, or 3 feet more than the depth at the proposed site, at the lowest spring tides. It will be evident, therefore, that the caisson cannot be placed in position at less than half tide; and, to allow sufficient time for securing it over the selected spot, this should be done on the flood. At half ebb the caisson will fall on the bottom, when the work of loading it with additional foundation stone will be prosecuted with great diligence, in order to prevent, if possible, its floating again on the rise of the tide. To effect so desirable an object, it will be necessary to take on board about 200 tons in the time that will elapse between half ebb and high water, or about 8½ hours. For this purpose two boom-cranes attached to the caisson, will be employed. These, fully manned, and unloading from separate vessels, will be able, in a favorable state of the weather, to take on board in the time above stated, 85 stones weighing 255 tons; affording a large excess of weight as a set-off against the difficulties and delays incident to so exposed a position, over and above the quantity required to retain the caisson on the bottom at any stage of the tide. The stone thus transferred to the caisson, will be placed conveniently on the decks for being laid by the masons. The eight mooring piles, attached to the caisson will now be driven, by the engine provided for the purpose, in order to prevent any lateral motion to which it may be liable from currents or waves, until the further loading shall make it perfectly secure. If from stress of weather, or other cause, the amount of labour calculated upon above be not accomplished, arrangements will be provided, for flooding the caisson to ensure its safety until such time as the work may be resumed.

The caisson being now secured, the next object is to prevent the sand of the shoal from being carried away by any new action, given by its presence,

to the current or the waves. This will be effected by paving the shoal with breakwater stone. To this end about 75 vessels will be provided, which, estimating their average load at 60 tons, will carry 4,500 tons, a quantity sufficient to cover the bottom to a depth of 3 feet for 60 feet round the caisson: allowing that this space will accommodate ten vessels at the same time, and that two hours would be required to unload a vessel, this quantity may be deposited, in moderate weather, in sixteen hours. The early completion of this measure is deemed so important to the success of the undertaking, that a large force will be employed to prosecute the work as rapidly as possible; and to insure, as far as practicable, a uniform distribution of the stone over the designated space, the place of each vessel and of her deposits will be represented on a diagram. No importance is attached to any minor irregularities which may occur in the paving, as the tides in flowing over the general surface of the stone, so far from removing the sand, will cause deposits in the spaces between the stone. And, again, with a view to compensate for any loss which may have occurred before the paving is completed, a result not anticipated, but principally to prevent the great sill-piece from the attacks of the worm, clean sharp sand will be deposited in large quantities alongside the caisson. The vessels, as they successively deposit their loads, will return to the quarries for more stone to form so much of the final mole as is considered necessary to place the work in a condition of safety against the storms of the approaching winter. This quantity is set down in the estimate at about 33,000 tons, and may be deposited in eleven weeks, or at the rate of 3,000 tons a week, the average quantity frequently received at the Delaware breakwater. The laying of the stone of the foundation rock will be resumed immediately, on the caisson becoming fixed upon the shoal, and the work vigorously prosecuted until completed. As two and a half courses will be laid before proceeding down the bay, but seven and a half of the ten courses will remain to lay after arriving at the shoal. These consist of 500 blocks, and as they will be furnished with lewis and cramp holes, and lettered and numbered, agreeably to diagrams in the hands of the workmen, the hope is entertained that even half the time stated above may be sufficient to finish this part of the work.

In thus laying down a plan of operations, it is not for a moment supposed that it will be expedient, or at all times practicable, to adhere to it. The object is more to elucidate general views in regard to the principles which should govern the mode of proceeding, than to point out the details, which, in a work of so novel a character, must depend upon circumstances which cannot always be anticipated, and must be provided on the spur of the occasion.

It now remains to give a revised estimate for the entire work, under the modifications and increase in prices already noticed. No revision has been made in the plan of the light house proper, or lantern, nor is it probable that any changes in either will be found necessary, that will materially affect the cost of the work. The present object is the successful establishment of the foundation, in which consists the only real difficulty in the construction.

Artificial island, or protecting mole.

14,734 tons of breakwater stone, of pieces of 2 tons and upward, at $3 00 per ton		$44,202 00	
25,037 tons of breakwater stone, of pieces of ¼ to 2 tons, at $2 00 per ton . .		50,074 00	
Cost of artificial island, or protecting mole, . . .			$94,276 00

Foundation.

Cost as already stated			$43,977 00

Light-house proper.

The original amount under this head was		21,787 75	
From which subtract (now estimated for in the foundation) the cost of 340 cubic yards of heavy building stone at $5 20 per cubic yard	$1,768 00		
And for laying the same at $17 20 per cubic yard	5,848 00		
Also for laying 148 cubic yards of superstructure, reduced from $17 20 to $8 60 : . . .	1,272 80		
		8,888 80	
Cost of light house proper			12,898 95

Lantern.

Cost, the same as originally estimated			1,340 39
			152,493 07
Contingencies, 17 per cent.			25,923 82
Total amount . . .			178,416 89

It is not improbable that complete security may be given to the structure short of the fulfilment of the profile on which the above estimate is founded, and that the protection given in the first instance may prove amply sufficient, reducing, correspondingly, the aggregate expense. The grounds for this hope may be found in the fact that the proportion of two to one given to the exterior slope of the latter work, is the same, up to the 30th September, 1836, as that of the Delaware breakwater, a work certainly exposed to greater shocks, though, on the other hand, more secure from the greater depth of water in which it is founded. The result may likewise show that the mason's work is set down at too high a rate. Nevertheless, it is deemed safest in a work constructed under such novel circumstances as the Brandywine light-house, to retain both the items at the highest rates, to meet any unforeseen contingencies to which the operation may be liable.

I have the honour to be, sir, very respectfully, your obedient servant,

Hartman Bache,

Major Topographical Engineers, &c.

Col. J. J. Abert, *Topographical Bureau.*

LUNAR OCCULTATIONS FOR PHILADELPHIA, JANUARY, 1841.					Angles reckoned to the right, or westward, round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
3	11	22	Im. 7 Tauri,	6	129°	185°
3	12	24	Em.		251	308
9	15	20	Im. A. Leonis,	5	60	76
9	16	33	Em.		226	262
10	15	39	Im. *d* Leonis,	5	101	105
10	16	27	Em.		179	198
24	4	28	Im. 37 Aquarii,	6	90	124
24	5	25	Em		342	23

Meteorological Observations for August, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	69	79	29 90	29 70	E.	Calm.	.40	Rain—flying clouds.
	2	71	79	.90	.90	S.W.	do.		Cloudy—do.
	3	71	80	.84	.90	S.W.	Moderate.	1.30	Cloudy—showery.
	4	68	83	.76	.72	W.	Calm.	.13	Clear—partially cloudy—rain.
☾	5	73	84	.72	.72	W.	do.		Partially cloudy—do. do.
	6	69	80	.72	.65	W.	do.		Partially cloudy—do. do.
	7	70	68	.64	.65	W.	do.	.08	Cloudy—showery.
	8	62	79	.66	66	W.	do.		Partially cloudy—clear.
	9	62	78	.88	.92	W.	do.		Clear—flying clouds.
	10	58	79	30.04	30 04	W.	Moderate.		Clear—do.
	11	66	82	.00	29 91	S W.	do.	.46	Clear—showery.
☉	12	62	80	29.84	.80	S.W.	do.	1.20	Cloudy—showery.
	13	70	72	.74	.66	S.W.	do.	2.30	Rain—do.
	14	69	78	.56	.61	W.	do.		Clear—do.
	15	65	80	.82	.88	N W.	do.		Clear—do.
	16	67	80	30 03	30.07	E.	do.		Cloudy—partially cloudy.
	17	67	79	.08	.21	N.E.	Calm.		Lightly cloudy—do. do.
	18	65	79	.20	.20	E.S.W.	do.		Cloudy—clear.
	19	66	81	.14	05	W S W.	do.		Clear—do.
☽	20	66	84	29.96	29.92	W.	do.		Clear—do.
	21	68	86	.90	.88	S.	do.		Clear—do.
	22	71	84	.88	.90	W	do.		Cloudy—clear.
	23	74	87	.85	.80	S W.	Brisk.	1.20	Lightly cloudy—rain.
	24	67	79	.76	.80	W.	Moderate.		Clear—do.
	25	64	78	.85	.90	N.	do.		Clear—do.
	26	59	70	30.00	30 00	N S W.	do.		Clear—do.
⊗	27	63	77	.00	29 95	N.W.	do.		Lightly cloudy—clear.
	28	65	75	29.95	.95	N.E.	do.		Cloudy—do.
	29	67	79	30 00	.97	N E.	do.		Cloudy—do.
	30	68	80	00	.95	S.	do.		Cloudy—do.
	31	72	81	29 85	.85	S.	do.		Cloudy—do.
	Mean	66.90	79 55	29.89	29.88			7.13	

Thermometer.			Barometer.	
Maximum height during the month.	87 00	on the 23rd.	30.21 on	the 17th.
Minimum " "	58.00	on the 10th.	29.56 "	14th.
Mean	73 22		29.885	

										Hygrometer.					
C		S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
1	6 3(	⅓	.	2	⅓	1⅓	1⅓	.	11⅓	....	.	.... .	....	.	1025
2															
3	0 30	⅔	⅓	⅔	⅔	11⅓	.	.	.	....	.	.....	....	.	1019
4															
5															
6	.	⅔	⅓	3⅔	⅓	5⅔	.	.	6⅔	....	.	.....	....	.	1020
7															
8															
9	4 28	⅓	.	8	.	2⅓	.	9⅓	.	....	.	.....	....	.	1050
10															
11															
12															
13															
14															
15	3 29.	⅓	1⅓	⅓	1	4⅓	⅓	.	⅔	43.78	3	.....	55.54	3	1038
16															
17															
18															
19	3 29		⅓	2⅔	⅓	3	.	1⅓	.	....	.	.....	50.50	.	1024
20															
21															
22															
23															
24															
25															
26	29	⅓	.	3⅓	.	4⅔	.	12⅔	1	....	.	.....	....	.	1052
27															
28	29	⅓	.	5	⅔	2	.	9⅓	.	....	.	.....	....	.	1039
29	29	⅓	⅓	4⅓	⅔	2⅔	.	3⅔	3	....	.	.....	....	.	1048
30															
31	29.		.	20⅔	.	.	.	.	⅓	....	.	.....	....	.	1035
32	29	⅓	⅓	3	.	5⅔	.	⅓	2⅔	....	.	.....	....	.	1091
33															
34	28	⅓	.	9⅓	⅓	4	.	.	1⅓	....	.	.....	57.42	4	1054
35															
36	27	⅓	.	7⅔	.	4⅓	.	3	1⅓	....	.	.....	...	.	1021
37	29	⅔	2	2⅔	4	3	⅔	.	.	....	.	.. .	....	.	1040
38	28	⅓	⅓	4	⅔	3⅓	.	5⅓	1	....	.	.....	....	.	1160
39	28	⅔	.	5	.	5⅔	.	11⅔	.	....	.	...	....	.	1058
40	.														
41	28.		.	5⅓	.	⅔	.	15⅓	1	....	.	....	....	.	1049
42	..	⅓	.	.	.	5	.	.	21	....	.	.....	....	.	1036
43															
44															
45	29.	⅓	.	5	.	2	.	4⅓	⅓	....	.	.....	....	.	1266
46															
47	29.		.	.	.	.	.	.	.	....	.	.....	....	.	1051
48															
49	29.	⅓	⅓	1⅔	⅓	6	.	5	3	....	.	.....	....	.	1226
50	28.		.	11	.	2	.	.	.	....	.	.....	....	.	1026
51	28.	⅔	.	.	.	⅔	.	4⅔	⅔	....	.	......	48.65	4	1041
52	28.	⅔	.	4⅓	⅓	3⅔	⅓	4⅔	2⅔	....	.	.....	....	.	1022
53	29.	⅓	⅓	5⅓	1⅓	2	1⅓	7⅓	.	....	.	.....	....	.	1061

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,
Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

APRIL, 1840.

County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.
1 Philadelphia.	Philadelphia,	J. M. Hamilton,	59.95	69.93	63.47	82.	51.00	64.45	12	34.00	45.74	3
2 Montgomery.												
3 Bucks,	Newtown,	L. H. Parsons,	51.27	63.60	49.48	84.	31.75	54.78	.	27.00	42.48	.
4 Lehigh.												
5 Northampton,	Easton,	Lafayette College,										
6 Monroe,	Stroudsburg,	A. M. Stokes,	45.75	61.35	46.07	86.	28.00	51.06	10	....	....	.
7 Pike,												
8 Wayne,												
9 Susquehanna,	Silver Lake,	E. W. Rose,	40.43	57.37	45.27	84.00	26.00	47.69	.	22.00	36.13	.
10 Luzerne,	Wilkesbarre,	W. F. Dennis,										
11 Schuylkill,												
12 Berks,	Reading,	C. F. Egelmann,										
13 Chester,												
14 Delaware,	Haverford,	Haverford School,										
15 Lancaster,	Lancaster,	Conservatory of Arts,	49.97	64.57	53.57	81.50	32.00	56.04	⅔	30.00	45.37	.
16 York,												
17 Lebanon,												
18 Dauphin.												
19 Northumberland.	Northumberland,	Andrew C. Huston,	50.15	60.37	51.78	79.00	32.00	54.10	.	24.00	40.57	.
20 Columbia,												
21 Bradford,												
22 Tioga,												
23 Lycoming,												
24 Union,												
25 Mifflin.												
26 Juniata,	Mifflintown,	J. A. Rinkead,	43.18	62.73	54.69	81.00	26.00	53.53	1	....	....	.
27 Perry,												
28 Cumberland.	Carlisle,	Prof. W. H. Allen,	49.17	61.97	51.43	80.00	31.00	54.19	.	27.00	44.00	.
29 Adams.	Gettysburg,	Prof. M. Jacobs,	40.68	55.33	46.98	82.00	31.50	47.67	3⅓	26.00	42.13	2
30 Franklin.												
31 Huntingdon.	Huntingdon,	Jacob Miller,	46.	64.10	52.10	83.00	30.00	54.07	⅓	....	....	.
32 Centre,	Bellefonte,	John Harris,	43.48	60.63	49.73	79.00	23.00	51.28	2⅔	....	....	.
33 Potter,												
34 M'Kean.	Smithport,	Richard Chadwick,	41.33	58.47	42.10	86.00	24.00	47.30	.	18.00	36.30	.
35 Clearfield,												
36 Cambria,	Ebensburgh,	Richard Lewis,	42.43	58.11	44.93	77.00	27.00	48.49	1⅔	25.00	38.55	19
37 Bedford,	Bedford,	Samuel Brown,	47.76	63.49	53.62	86.00	29.00	54.96	.	....	....	.
38 Somerset,	Somerset,	George Mowry,	46.78	56.61	47.62	76.00	27.00	50.34	1⅓	24.50	41.27	.
39 Indiana,	Indiana,	Richard White,	59.87	63.60	46.55	90.00	31.00	56.67	.	....	....	.
40 Jefferson,	Rose Cottage,	C. C. Gaskell,										
41 Warren,	Warren,	R. Brown,	45.26	63.	46.07	89.00	20.00	51.44	1	....	....	.
42 Venango,	Franklin,	Wm. Connely,	38.97	64.	50.70	92.00	18.00	51.22	.	....	....	.
43 Armstrong,												
44 Westmoreland,												
45 Fayette,	Uniontown,	J. P. Weithers,	50.70	62.47	55.33	84.00	29.00	56.17	⅓	23.00	31.40	25
46 Green,												
47 Washington,	Cannonsburg,	Jno. H. Kennedy.	44.83	64.83	53.03	86.00	25.00	54.23	.	25.00	43.20	.
48 Alleghany,												
49 Beaver,	Beaver,	Wm. Allison,	48.41	64.54	50.62	86.00	27.00	54.52	2	....	....	.
50 Butler,	Butler,	Jacob Mechling,	46.60	61.80	54.60	84.00	23.00	54.33	.	....	....	.
51 Mercer,	West Greenville,	S. Campbell,	48.47	61.07	52.14	78.00	29.00	53.89	⅔	29.00	45.66	1
52 Crawford,	Meadville,	J. Limber,	50.97	60.03	51.50	86.00	31.00	54.17	.	26.00	42.57	2
53 Erie,	Erie,	Park & Reid,	48.13	53.07	47.32	74.00	28.00	49.51	⅔	19.00	37.68	.

County.	Barometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Weather. Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.
1 Philadelphia.	30.27	30.26	30.26	30.63	29.93	30.26	11⅔	15	3⅓	11⅔	....	....	....	..	....
3 Bucks,	30.06	30.00	30.01	30.45	29.45	30.02	.	15⅔	12⅓	2	....	....	....	..	7.785
6 Monroe,	....	....	....	....	....	...	.	5⅔	13⅓	11	....	....	....	..	......
9 Susquehanna,	28.06	28.04	28.07	28.90	27.50	28.06	.	18	12	.	....	....	....	..	2.310
15 Lancaster,	29.61	29.58	29.57	30.00	29.08	29.59	⅔	17⅓	12	⅔	8	....	....	1	4.855
19 Northumberland.	29.53	29.48	29.48	29.90	29.13	29.60	.	12⅓	17⅔	.	4	1	....	1	3.263
26 Juniata,	29.55	29.53	29.50	29.90	29.20	29.53	1⅓	13⅓	14	2⅔	....	....	....	..	4.290
28 Cumberland.	29.45	29.39	29.40	29.81	28.95	29.41	.	14⅔	15⅓	.	5	....	....	3	4.503
29 Adams.	29.45	29.42	29.43	29.84	29.12	29.43	3	15⅓	11⅔	3	7	....	1	1	3.943
31 Huntingdon.	29.42	29.36	29.39	29.73	28.92	29.39	⅔	2	9	.	7	1	....	1	4.108
32 Centre,	29.33	29.31	29.31	29.67	28.83	29.32	2⅔	12⅓	15	2⅔	9	1	....	..	1.950
34 M'Kean.	28.09	28.10	28.14	28.32	27.70	28.11	.	13	17	.	.	.	....	..	2.740
36 Cambria,	27.86	27.86	27.85	28.11	27.41	27.86	1⅔	8⅓	19⅓	2⅓	7	.	....	2	4.144
37 Bedford,	29.29	29.23	29.27	29.57	28.82	29.26	.	15⅔	14⅓	.	.	.	....	..	......
38 Somerset,	28.06	28.01	28.09	28.18	27.58	28.05	1	12⅓	16⅔	1	4	1	1	6	4.695
39 Indiana,	28.65	28.63	28.64	28.90	28.30	28.64	.	18⅔	11	⅓	9	....	....	..	3.975
41 Warren,	28.94	28.92	28.95	29.75	28.50	28.94	1	15⅓	13⅔	1	....	....	...	..	......
42 Venango,	....	29.09	....	29.98	28.69	29.09	21	.	.	.	....	....	....	..	......
45 Fayette,	29.04	28.99	29.02	29.30	28.45	29.02	⅓	20	9⅔	⅓	8	....	1	1	3.562
47 Washington,	29.11	29.08	29.10	29.37	28.80	29.10	.	16	13	1	9	....	....	..	2.365
49 Beaver,	29.41	29.35	29.44	29.76	29.06	29.41	2⅓	12⅓	15	2⅔	8	1	....	..	2.875
50 Butler,	28.92	28.90	28.92	29.15	28.60	28.91	.	.	.	.	7	1	....	..	3.190
51 Mercer,	28.71	28.71	28.75	28.99	28.04	28.72	.	13⅓	16	⅔	8	....	....	..	......
52 Crawford,	28.75	28.74	28.73	29.03	28.33	28.74	.	12	18	.	12	1	....	1	3.028
53 Erie,	29.47	29.48	29.46	29.86	29.04	29.47	.	12⅓	17⅔	.	6	1	....	..	2.021

County.	Winds. North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.
1 Philadelphia.	1	⅔	1⅓	⅓	⅔	⅓	1⅓	.	6⅓	⅓	1⅓	.	2	⅓	1⅓	1⅓	.	11½
3 Bucks,	.	.	2⅓	.	⅓	.	2⅓	.	⅓	⅔	10⅔	⅓	⅔	⅔	11⅓	.	.	.
6 Monroe,	3	.	.	1	1	⅓	⅓	.	2	.	5⅔	⅓	3⅔	⅓	5⅔	.	.	6⅔
9 Susquehanna,	.	.	.	.	.	.	2	.	3	.	5⅓	.	8	.	2⅓	.	9⅓	.
15 Lancaster,	3	1	⅓	⅔	1	⅔	3	⅓	5⅔	2	4⅓	1⅓	⅓	1	4⅓	⅓	.	⅔
19 Northumberland.	4⅔	.	1⅔	.	1⅓	.	2⅔	⅓	9⅔	.	2	⅓	2⅔	⅓	3	.	1⅓	.
26 Juniata,	.	.	1	.	⅔	.	2⅔	.	⅔	.	3⅓	.	3⅓	.	4⅔	.	12⅔	1
28 Cumberland.	⅔	.	1⅓	.	3	.	2	.	2⅔	.	3⅓	.	5	⅔	2	.	9⅓	.
29 Adams.	4⅓	.	⅓	.	⅓	.	⅓	.	5⅓	2⅓	2⅓	⅓	4⅓	⅔	2⅔	.	3⅔	3
31 Huntingdon.	.	.	.	.	9	.	.	.	.	.	.	.	20⅔	.	.	.	.	⅓
32 Centre,	1	.	2	.	.	.	3	.	1⅔	.	10⅓	⅓	3	.	5⅔	.	⅓	2⅔
34 M'Kean.	.	.	.	.	4	.	2	.	⅔	.	8⅓	.	9⅓	⅓	4	.	.	1⅓
36 Cambria,	1	.	⅓	.	1	.	6⅔	.	1⅓	.	3⅓	.	7⅔	.	4⅔	.	3	1⅓
37 Bedford,	.	.	.	.	.	.	3	3⅓	.	7⅓	2⅔	2	2⅔	4	3	⅔	.	.
38 Somerset,	⅓	.	⅔	.	⅔	.	2⅓	.	⅔	.	10⅓	⅓	4	⅔	3⅓	.	5⅓	1
39 Indiana,	.	.	.	.	.	.	2⅓	.	2⅔	.	2⅔	.	5	.	5⅔	.	11⅔	.
41 Warren,	2	.	.	.	⅔	.	.	.	5	.	.	.	5⅓	.	⅔	.	15⅓	1
42 Venango,	.	.	.	.	.	.	3⅔	.	.	.	⅓	.	.	.	5	.	.	21
45 Fayette,	⅓	.	1⅓	.	.	.	2⅓	.	.	.	14⅓	.	5	.	2	.	4⅓	½
47 Washington,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49 Beaver,	⅓	.	2⅔	⅓	⅓	.	1⅓	.	1	⅓	7⅓	⅓	1⅔	⅓	6	.	5	3
50 Butler,	.	.	1⅓	.	6	.	2⅓	.	1	.	6	.	11	.	2	.	.	.
51 Mercer,	9⅓	.	.	.	.	.	⅓	.	13⅓	.	.	.	.	.	⅔	.	4⅔	⅔
52 Crawford,	1⅔	.	.	.	.	.	⅓	1	7⅔	⅓	2⅔	.	4⅓	⅓	3⅔	⅔	4⅔	2⅔
53 Erie,	2	.	1⅓	.	.	.	.	1⅓	5⅓	⅔	1⅓	⅓	5⅓	1⅓	2	1⅓	7⅓	.

County.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
1 Philadelphia.	....	.	....	....	.	1025
3 Bucks,	....	.	.....	....	.	1019
6 Monroe,	....	.	.....	....	.	1020
9 Susquehanna,	....	.	.....	....	.	1050
15 Lancaster,	43.78	3	.....	55.54	3	1038
19 Northumberland.	....	.	.....	50.50	.	1024
26 Juniata,	....	.	.....	....	.	1052
28 Cumberland.	....	.	.....	....	.	1039
29 Adams.	....	.	.....	....	.	1048
31 Huntingdon.	....	.	.....	....	.	1035
32 Centre,	....	.	.....	....	.	1091
34 M'Kean.	....	.	.....	57.42	4	1054
36 Cambria,	....	.	.....	...	.	1021
37 Bedford,	....	.	.. .	....	.	1040
38 Somerset,	....	.	.....	....	.	1150
39 Indiana,	....	.	...	....	.	1058
41 Warren,	....	.	....	....	.	1042
42 Venango,	....	.	.....	....	.	1036
45 Fayette,	....	.	.....	....	.	1036
47 Washington,	....	.	.....	....	.	1051
49 Beaver,	....	.	.....	....	.	1025
50 Butler,	....	.	.....	....	.	[illegible]
51 Mercer,	....	.	.....	48.65	4	1041
52 Crawford,	....	.	.....	....	.	[illegible]
53 Erie,	....	.	.....	...	.	1061

// JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

DECEMBER, 1840.

Civil Engineering.

Letters from the United States of North America on Internal Improvements, Steam Navigation, Banking, &c., written by Francis Anthony Chevalier de Gerstner, *during his sojourn in the United States, in* 1839.

(Translated from the German, by L. Klein, Civil Engineer.)

(Continued from page 301.)

Letter V.

Macon, Georgia, May 1, 1839.

Legislative Acts concerning the Establishment of Railroads.

Each of the states, which form the American Union, is for itself, independent and sovereign, as the Federal Government at Washington is limited to some branches of administration only, while the principal legislation and government are left with the states. We therefore find in the twenty-three states, where railroads have already been introduced, much difference of legislation and manner of support of these works; the following points, however, may be mentioned, as common to most of the states.

1. *The right of way* for the road itself as well as for the stations, depots, etc., is procured either by free consent of both parties, or by appraisement in case of nonagreement. The appraisers are expressly instructed to appraise, not only the damage, but also the advantage arising to the landowners by the construction of the railroad. Two years ago when the railroad bridge across the Roanoke river, at Gaston, was to be constructed, the proprietor of the ferry at that place demanded 25,000 dollars, as an indemnification for his loss; but the appraisers estimated the increase of the value of the adjoining

lands, belonging to the same proprietor, at 20,000 dollars, and he had to content himself with 5000 dollars. In many cases land owners were induced to cede, without compensation, the necessary land for the railway, and in forests the use of timber in the line of the road, because his profit, arising from the increase in the value of his property, was as large or larger than the value of the ceded land. In Europe, appraisers have, to my knowledge, never estimated the profit arising to the land proprietor by the construction of a railroad or any other road.

2. *Location and grades.* In all states of the Union it is left to the Railroad Companies to determine themselves the line, profile, etc., of the railroads. In the charters the two terminating points of the line only are generally specified, seldom one or two intermediate points. The Companies, or the Boards of Directors, have therefore full, free action, but the Directors and Engineers are answerable to the Shareholders and the public, for the adoption of the best route, and cannot, as it is often the case in Europe, and principally in France, excuse themselves with the assertion that a plan, when once sanctioned by the higher authorities, is to be regarded as the plan of the latter, and Directors and Engineers are no more to answer for it.

3. All the iron rails, etc., necessary for the construction of a railroad, may, according to an act of Congress passed several years ago, be imported duty free. Although flat bars are rolled in several American iron works, the English iron is preferred here on account of its lower price.

4. The Officers, Conductors, Engineers, and other persons employed on railroads, are, in most of the states, exempted from militia service.

5. The charters are granted to railroad companies free of charge; in a very few cases only a certain per centage of the revenue is to be paid to the State Government. In most of the states the railroads are free from taxation.

6. Some of the charters grant exclusive privileges, in conformity to which no other railroad can, within twenty or even fifty years, be established at a certain distance from the one chartered; the railroad, however, remains forever the property of the company.

7. The tariff for the transportation of passengers and freight is always based on liberal principles, and in no single case has the state made it as a condition, that troops, state property, the mail, etc., be transported at a lower price, than other passengers or freight.

8. Any damage done to the road, or the stealing of any object belonging to it, is severely punished; if by the injury done, as, for instance, the tearing off of a rail, the lives of the passengers should be endangered, it is lawfully to be regarded as a criminal offence.

9. Some of the states preserve to themselves the right to purchase the railroad after a certain period, but in every such case the shareholders are to receive back the capital expended, together with ten per cent. per annum, on the same from the day of the first instalment.

Subscription of Capital Stock by the State.

Besides the above enumerated general assistance on the part of the state governments, direct aids are often rendered to those companies upon whose railroads there is not sufficient traffic to yield sufficient interest on the investments of private individuals. In such a case the Legislature promises in the charter, to subscribe for and pay in a part of the capital stock as soon as the remainder of the stock is disposed of by private subscriptions. The landowners and merchants of the county adjoining the line, then take a part

of the shares, and the state the other. In the state of *Virginia*, by an existing law, the state subscribes for two fifths of the capital stock of every railroad, as soon as the remaining three fifths of the capital are subscribed by private individuals. Virginia now has 335 miles of railroads in operation, for which 5,000,000 dollars have been expended. The population of the state was, in 1830, only 741,648 whites, and 469,757 blacks, upon an area of 66,624 square miles. As the negroes cannot quit their homes, except when accompanying their masters on their journeys, we can only reckon eleven white inhabitants per square mile, as belonging to the traveling public, and since, as I have shown in my last letter, far the greatest part of the profit upon rail roads arises from the conveyance of passengers, Virginia, with her comparatively small population, would certainly be without railroads had not the state government taken such a liberal course towards their introduction.

Banking Privileges of Railroad Companies.

The establishment of banks, of which I shall have occasion to speak in my future letters, belongs to the most profitable undertakings in the United States. In some of the states the number of banks is so large, it is true, that the profit of the stockholders seldom exceeds 6 or 7 per cent., but in other states, on the contrary, the banks yield 10, and more, per cent. yearly dividend. In such states banking privileges have been granted under the condition, that the banking company establishes a certain railroad; of the instalments made by the stockholders in such case, one half is generally to be applied to the construction of the railroad, the other half for banking purposes. It is calculated that the bank will yield 10 or 12 per cent. interest, the railroad only 4 per cent., so that the whole capital invested brings from 7 to 8 per cent. interest, which is regarded as sufficient.

Four years ago the state of *Georgia* had no railroads, because the population at the last census was only 299,292 whites upon an area of 61,500 square miles, or five white inhabitants per square mile, and consequently private individuals would not embark their capital in railroads. The government resolved to establish a line of railroad, 134 miles in length, through the most difficult part of the country, at the expense of the state, with a probable cost of about 4,000,000 dollars, and to grant banking privileges for twenty-five years to three companies, under the condition that they construct 500 miles of railroads through the principal parts of the country. The cost of the latter will amount to 7,200.000 dollars, which sum is nearly all to be paid in by private individuals, as the state only promised to take stock in three branch roads to the amount of 600,000 dollars. There are at present in Georgia 182 miles of railroads in operation, the remainder are mostly in progress of construction, and the whole system of railroads in this state is expected to be completed in eighteen months. This state, therefore, which, in 1830, had a population of only five white inhabitants per square mile, will, within two years, possess 634 miles of railroads, or just as many as the whole continent of Europe now can boast of. The state contributes to their construction 4,600,000 dollars, and private individuals 6,600,000 dollars, both therefore 11,200,000 dollars. Without banking privileges private individuals would never have embarked in these undertakings, as the lawful interest in this state is 8 per cent., and capital may be safely invested at such high interest; but as soon as banking privileges were granted for a term of twenty-five years, with the provision that the notes of the companies be taken in payments to the state in their full value, the shareholders

found their investment a safe one, and the construction of three railroads was immediately begun. For the present the companies derive their profits nearly exclusively from the banking operations, but the rapid increase in the traffic upon the roads will augment the profit from the railroad itself from year to year, and in twenty-five years, when the charter for the bank expires, the intercourse upon these railroads will be sufficiently large that the shareholders may dispense with the banking privileges.

Loans from the part of the States.

In those states where banks, in consequence of their being so numerous, do not yield great profits, or where the governments will not allow of their multiplication, railroad companies often receive, on their application, loans guaranteed on the part of the states. The charter then usually contains the provision, that the company has to expend first 100,000 dollars of their own means, after which they receive state scrips to the amount of 50,000 dollars, the payment of the capital and interest of which is guaranteed by the state; when the company again expend 100,000 dollars of *their* means, they receive further scrips to the amount of 50,000 dollars, and so on. Other works, undertaken by private companies, and finished in part, have sometimes to be stopped for want of means, and the state, by guaranteeing a loan, forwards their completion. In every such case the railroad is mortgaged to the state, and its revenues, after deducting the current expenses, have first to be applied to the payment of the interest on the loans thus guaranteed. Of these loans part were negotiated in America, but the greater portion in England; the common rate of interest is from 5 to 6 per cent., and the scrips are usually sold at par, and sometimes at a premium as high as 10 per cent. Thus the Americans construct their railroads in part with British gold; they pay annually the interest out of the proceeds of their works, and the country enjoys the advantages of a facilitated intercourse.

The Debts of the States.

The Federal Government of the United States has, as is generally known, several years back paid off all debts, contracted since the war of independence, and, moreover, in 1837, distributed amongst the several states 37,500,000 dollars out of the surplus revenue. Since that time the general government has emitted treasury notes at different periods, but they have always been redeemed at maturity. The several states, however, have made considerable loans for Canals, Railroads, and Turnpike roads, and for Banking purposes. Only a small part of these loans was applied for common roads; the construction of which has almost entirely been abandoned in America, since a better kind of roads, that is *railroads*, were introduced.

From a statement recently made out from authentic information it appears that nineteen states of the Union have, since 1820, contracted the following debts, viz:

For Railroads, Canals and Turnpike roads	\$98,001,244 39
For Banking . . .	51,315,000 00
For other purposes . .	4,804,759 28
Total . .	\$154,121,003 67

Of which, however, a part was again loaned to companies of stockholders, and has to be repaid by the latter. The amount of loans guaranteed by the Legislatures in their last session, to railroad companies principally, is proba-

bly not less than 16,000,000 dollars; the public debts of the several states for Internal Improvements alone amount, therefore, now to about 114,000,000 dollars; the greater part of the loans is already realized, and the remainder will be obtained in the course of one or two years. Only a small part of the state bonds are in the hands of Americans, the greatest part was negotiated in England, and the bonds are either in England or in other parts of Europe. The United States pay, therefore, annually to Europe 5,000,000 dollars as interest on their debts for railroads, canals and turnpike roads, and this amount of interest will, in the next few years to come, be materially enlarged by the new works that are constantly undertaken. Few Americans are of opinion, that their country will be impoverished by paying, annually, such a large amount of interest, and at maturity also the capital borrowed; most of them are, on the contrary, convinced that the Internal Improvements have so much increased the prosperity of their country that not only the interest, but also the capital itself will be brought in before it falls due, and that the accomplished improvements will still remain as a surplus gain to the country. Might the same views predominate in the states of the continent in Europe!

Letter VI.

New Orleans, May 20, 1839.

Banks in Louisiana.

In my last letter I stated that the state of Georgia has granted banking privileges for twenty-five years to three railroad companies, under the condition that they build 500 miles of railroads in the principal lines of intercourse; that 182 miles of railroads are already in operation, and the remainder will probably be completed within two years. The legal interest in Georgia is 8 per cent., and private companies would never have undertaken to construct such large railroads, had the banking privileges not secured to them a fair interest on their investments.

In the state of *Louisiana* the scarcity of money is, notwithstanding the production of cotton and sugar, still greater, and the lawful interest is here 10 per cent.; private individuals, speculating with prudence, can profit even 15 to 20 per cent.; how could it, therefore, be expected that funds might be obtained for public works, which, in such a thinly settled country, cannot be expected to yield a great profit. And yet large undertakings have been executed in the last six or eight years in the state of Louisiana, supported nearly all by banking privileges.

1*st. Canal from New Orleans to Lake Pontchartrain.*

On the 5th of March, 1831, the state granted a charter for the formation of a company under the name of the "*New Orleans Canal and Banking Company;*" this company was to pay in 4,000,000 dollars, in 40,000 shares at 100 dollars, to construct a canal from the interior of the city of New Orleans, through the Cypress Swamps, to Lake Pontchartrain, and to apply the residue of the capital for banking purposes. The canal was to be sixty feet wide on the water surface, and deep enough to be navigated by vessels drawing six feet water. Within the city was to be constructed a basin, and on Lake Pontchartrain a sufficiently safe harbor; the work was to be commenced within one year, and completed within six years, or the charter was to be forfeited. The company can take a toll of thirty-seven and a half cents, at the maximum, for every ton of the vessel's tonnage, and after thirty-five

years from the passage of the act, the canal as well as the road constructed along side of it, belongs to the state, in consideration of which the company pays no taxes during thirty-five years—the period of their charter.

The construction of this canal, which is of so great importance for the city of New Orleans, was accompanied with very great difficulties; the Cypress swamps, through which the canal passes, being so injurious to the health, that during the time of the Cholera, in 1833, 6000 of the Irishmen occupied in excavating the canal, were buried on its banks. Although the canal is only six miles in length, the construction of it lasted from November 1831, to the 27th of December, 1835, when the first vessel passed through it; the total disbursement of the company was, to the end of December 1838, 1,350,000 dollars, and as it is intended to enlarge the canal next year to 120 feet, in order to make it navigable for steamboats, the total cost will probably be increased to about 2,000,000 dollars. The receipts on canal tolls have hitherto been

In 1836 . . .	$ 8,843 76
" 1837 . .	13,227 24
" 1838 for canal tolls	18,275 84
" —— for turnpike tolls	3,109 70

From these receipts must be deducted the expenses of maintaining the canal, which are considerable, in consequence of the wages of a carpenter or mason being here three dollars per day, of a common laborer at least one dollar and a half. Without banking privileges, therefore, the company would not have found this a profitable undertaking.

2d. New Orleans Water Works.

On the 1st of April, 1838, the state of Louisiana granted a charter for the formation of a company with a capital of 3,000,000 dollars; this company was to provide the city of New Orleans with pure water, to construct the works, etc., necessary for that purpose, and to apply the residue of the capital for the establishment of "*The Commercial Bank;*" the company had further the obligation to expend annually at least 100,000 dollars, until the greatest part of the city and suburbs is provided with water. The payments for water, obtained from these works, was to be proportioned so that the company may get, in the first five years, a clear profit of 15 per cent. at the maximum, and in the following years only 10 per cent. After the expiration of thirty-five years the city may purchase the water works and its appurtenances at a price to be determined by appraisement, and five years after, or in any case within fifty years from the day of the passage of the act, the banking privileges expire.

In conformity with this charter, the company has constructed a large reservoir, into which the water is raised from the Mississippi by steam power, and then conducted through pipes, the aggregate length of which is already twenty-three miles, to the different parts of the city. A family of six persons pays annually twenty dollars as water rent, for every person over six two dollars additional; two children under fifteen years of age are counted for one person. The owner of a public house (hotel) pays fifty dollars per year, and three per cent. of the house rent. For a horse is paid three dollars, for a carriage three dollars, for a bath in a private lodging five dollars, for a bath in a public house fourteen dollars per year, etc. As yet not the fourth part of the city is provided with water, and nevertheless the expenditure of the company amounts already to 900,000 dollars. The revenue or water

rent was, in 1837, only 8,000 dollars, and in 1838 17,000 dollars; in 1839 the company expects an income of 25,000 dollars. It is clear that the works would not have been undertaken without the profits being secured by banking privileges.

3d. Gas Works in New Orleans.

To light the city of New Orleans with gas had been repeatedly tried by individuals without success, until a banking privilege was granted on the 1st of April, 1835, to a company, styled the "*New Orleans Gaslight and Banking Company.*" The capital stock is 6,000,000 dollars, of which only one-third has been paid yet; 450,000 dollars have been expended on the gas works, and twelve miles of main pipes and forty miles of lateral pipes were laid down, which conduct the gas to 3,500 lights. The company lays down the pipes to the housedoors, and the houseowner pays for the arrangements in the interior of the house. There is a gas-meter in every house, and seven dollars are paid for every 1000 cubic feet of gas consumed. The stone coal, from which the gas is obtained, comes from Pittsburg, 2000 miles down the Ohio and Mississippi rivers, and costs, notwithstanding, per bushel, of eighty-four pounds, only eighteen cents. The revenues of the gaslight company are much larger than those of the two companies formerly mentioned.

4th. American Exchange Hotel in New Orleans.

The population of the city of New Orleans consists in 25,000 French, 20,000 American inhabitants and 30,000 slaves, together 75,000 souls. In winter from 10,000 to 15,000 strangers arrive in the city, a part to enjoy the mild climate, and another for transacting business; but in summer, on the contrary, a great part of the population leaves the city, to avoid the then raging fevers. Still a few years ago there was a general complaint about the want of a good hotel, and who would have established such in a city, from which the greater part of the inhabitants hurry away in May, and do not return until the end of October? The state of Louisiana, therefore, granted, on the 26th of January 1836, a charter to the "*Exchange and Banking Company,*" fixing the capital at 2,000,000 dollars. This company was bound to erect a hotel at an expense of not less than 300,000 dollars, exclusive of the price of the ground. The stockholders, all Americans, erected a hotel, which more resembles a palace, and expended for the same 650,000 dollars. Although the annual rent of this house amounts to 30,000 dollars, still the expenses for the maintenance of such an establishment and principally of its outfit, are so large, that the company would never realize their profits without their banking privileges.

5th. French Exchange Hotel in New Orleans.

The French inhabitants of New Orleans are always in some kind of opposition with the Americans, and they obtained, in consequence, on the 9th of February, 1836, a charter for the formation of a company entitled the "*Improvement and Banking Company.*" The capital of this company consists of 2,000,000 dollars, with which a large hotel was erected in the French part of the city, and besides three steamboats purchased for excursions to the environs of New Orleans, the remainder of the capital is employed in banking. The banking privilege is granted for twenty-five years. The company erected the hotel in a most magnificent style, at an expense of 920,000 dollars, and expended 90,000 dollars for steamboats. The great

profits from the bank, together with the moderate ones from the hotel, the exchange and the steamboats, give an interest with which the shareholders are contented.

Railroads with Banks.

The landowners (cotton and sugar planters) in Louisiana have hitherto been much restricted in their operations, for the reason that the plantations require large capitals for their cultivation, which do not return until the end of the year. The plantations are here entirely worked by negroes, as the white labourers cannot endure the climate; the price of a negro from twenty to thirty years of age is from 1,500 to 2,000 dollars (at a public auction in Alabama, at which I was present, from 400 to 500 dollars were paid for negro girls of ten years of age.) Provisions, as grain, beef, pork, poultry, etc., are seldom produced in the Southern, but come from the Western states, as far as 2,000 to 3,000 miles, and their prices are, consequently, very high. A planter with but little capital, therefore, had to borrow money at an exorbitant per centage, the lawful interest in Louisiana being as high as 10 per cent. The state resolved, therefore, to create "*Real Estate or Property Banks*," in which the stockholders do not pay in their instalments in cash, but rather in bonds and mortgages on real estate, for which, under the guaranty of the state, loans are negotiated in Europe. The stockholders then have the privilege of borrowing money from the bank to the amount of one half the value of their mortgages, at an interest of 6½ per cent.; the dividends on the shares, however, are not paid annually to the shareholders, but added to the capital and divided only after a certain number of years. In this manner three Property Banks were instituted: the "*Consolidated Association*," with a loan from the state of 2,500,000 dollars, the "*Union Bank*," founded on a loan of 7,000,000 dollars, and the "*Citizens' Bank*" on a loan of 6,000,000 dollars, which latter, however, can be increased to double that amount. The loans for the first two banks were negotiated in London, that for the Citizens Bank, in Amsterdam. As the system of the property banks is regarded as excellent, and could be imitated in Europe, I think it of interest to communicate here an extract of the statutes of the Citizens' Bank, which was the last chartered, and for which the experience acquired in the other two banks has been made use of.

The charter of the Citizens' Bank was granted on the 30th of January, 1836. 1. The bank is founded upon mortgaged property to the value of 14,400,000 dollars, upon which security the state guarantees a loan of 12,000,000 dollars, or at the rate of 100 dollars for every 120 dollars worth of real estate. There may be mortgaged: cultivated lands, slaves, houses and lots in town, if they bring a rent; one fifth of the mortgaged property can consist in uncultivated lands. The lands are taken only at their cash value, and the titles to the lands have to be well proved. 2. The directors of the bank borrow upon the mortgaged property to the value of 14,400,000 dollars, the sum of 12,000,000 dollars, or at the rate of 100 dollars for every 120 dollars worth of the mortgage, and the state of Louisiana guarantees the payment of the capital and interest; the interest is 5 per cent., and the capital is to be repaid in five equal instalments in 14, 23, 32 and 50 years, from the 1st of February, 1838. 3. The bank transacts every business connected with banking, issues notes and bills, purchases and sells domestic and foreign bills, lends money upon real estate, buys and sells all kinds of securities and also precious metals, provided, however, that the loans, discounts, and other advances taken together do not exceed double the amount of the

effective capital of the bank. 4. The rates of discounts of the bank cannot exceed 6 per cent. for bills payable within 124 days, 7 per cent. for bills payable after 124 days, and $6\frac{1}{2}$ per cent. on loans upon mortgages. 5. The state of Louisiana is authorised to borrow from the bank 500,000 dollars at 5 per cent. interest, on the same terms as are fixed for the stockholders of the bank. 6. As all the stockholders of this bank mortgaged their property for their instalments, they may, on depositing their shares, borrow from the bank one half of the amount for which their property is pledged; but they are obliged to repay at least one year before the expiration of each of the periods, mentioned under No. 2, 20 per cent. of the sum borrowed. If, therefore, all the stockholders avail themselves of this privilege, the bank has to lend 7,200,000 dollars to the stockholders at $6\frac{1}{2}$ per cent. interest, and can only carry on the other business with a surplus capital of 4,800,000 dollars. 7. Private individuals, who own no stock of this bank, may borrow money from the bank upon real estate for a term of ten years, but must repay each year at least one tenth of the capital. 8. Individuals who are building houses, may borrow from the bank to the amount of one half the value of the lots and buildings, but have to pay 7 per cent. annual interest, and besides 1 per cent. for commission. 9. The bank cannot issue notes of a smaller denomination than five dollars. 10. Each stockholder is at liberty to sell his shares, but the purchaser has to give a security upon real estate, to be approved of by the majority of the directors. 11. During the term of the charter of fifty years, the bank does not pay any state or county taxes. 12. The state nominates six, and the stockholders, also, six directors. On the first Monday in February of each year, all directors are newly elected. The President, who has the principal management of the affairs of the bank, receives a salary, but not the other directors. 13. After the bank has paid the interest at 5 per cent. on the loan negotiated in Holland, and defrayed all expenses incident to the management of the bank, the net profit is disposed of in the following manner, viz: the state of Louisiana, for lending its credit, receives one sixth of the profit if all 12,000,000, and one twelfth of the profit if only 6,000,000 dollars were borrowed; this part of the profit is to be applied for the primary schools in the state. The annual dividend of the stockholders is put to their credit, until the first instalment of the loan is paid back; after this the stockholders get one fifth of the profit and the remainder is again put to their credit until the second series of the loan is repaid, and so on. After the payment of the last series in fifty years, the stockholders receive the whole dividend.

The advantages of this bank to the planters in Louisiana is so great, that its results are already every where visible, and in the course of a few years the situation of the planters, who formerly were in the hands of usurers, will be still more materially improved. The shares of the company do not bring any dividends yet, as the profit is only put to their credit; but they sell now, three years after the bank went into operation, at 120 instead 100 dollars, or at an advance of twenty per cent.

TO BE CONTINUED.

The Laws of Trade applied to the determination of the most advantageous fare for Passengers on Railroads. *By* CHARLES ELLET, JR., ESQ., C. E.

If any explanation were needed for the publication of this paper, it is probable that a sufficient one might be offered in the fact that the railroads now constructed, and in progress of construction, in this country, will cost

from two to three hundred millions of dollars; and that the tariffs of charges are nearly always the result of the most vague conjecture, and frequently such as greatly to reduce the revenue which they might be made to yield.

The writer has elsewhere exposed the incorrectness of the present method of assessing the charges on heavy tonnage, and endeavoured to offer the means by which, it is believed, the proper rates may, on that part of the business of the work, be determined with great certainty. The present paper is intended to extend the application of the same principles to the matter of fares for passengers on railroads; a question which is equally susceptible of being subjected to a process of accurate reasoning, and which furnishes equally correct premises for the foundation of the argument. And if these premises have been justly assumed, and the conclusions fairly deduced, it may be averred, without risk of exaggeration, that the neglect of the results obtained from them, induces a loss to the proprietors of the railroads in this country alone, amounting annually to several millions of dollars.

The establishment of the tariff for an important improvement, is a momentous question for the company; and one which requires as careful an investigation of the facts, and the exercise of as much sound judgment, as any other which the engineer is likely to encounter in the course of his professional practice. The most consummate skill may be applied in the location and construction of the work and its appendages; and the entire success of the enterprise may still be marred by the subsequent injudicious administration of its affairs.

But it is not for the computation of the charges only that an attention to the requirements of the laws of trade is essential to the prosperity of the undertaking. In deciding on the character and location of the work, and adopting a system of transportation, it is equally imperative. It is as impossible to select the most appropriate plan of construction, and make choice of the most advantageous location, without a proper regard to the amount and nature of the business to be transacted, as it is to assess the charges without an attention to the cost of freight, and the value of the article to be conveyed. A road intended for the accommodation of a trade of 100.000 tons, or passengers, will generally be placed on very different ground, and ought always to be built in an entirely different manner, from those which would be adopted if a trade of but 10,000 tons were anticipated. In both cases, the inequalities of the natural surface must be more or less removed, for the purpose of reducing the expense of transportation; but the outlay justifiable for this object is wholly governed by the value of the object, which is dependent on the amount of trade. The heavy excavations and embankments are made for the purpose of reducing the price of freight; and if the trade be 100,000 tons, it will be worth 100,000 cents, or 1000 dollars, per mile per annum, to reduce the cost of transportation one cent per ton per mile. This sum is equivalent to a capital of some 16,000 dollars—the expense which might be incurred on each mile of a road of such expectations, in order to reduce the freight the amount designated. But, if the trade is to be only 10,000 tons, the same object, by this reasoning, would only justify an outlay of about 1,600 dollars; and consequently the road intended for the light trade would, of necessity, be placed on very different ground from that which would be chosen for the other.

The outlay should never be more than commensurate with the object for which it is incurred; and, therefore, the first and most important data to be provided by the engineer, in the incipiency of the enterprise placed under his professional guidance, are the value of the object contemplated by the

undertaking—the amount of the trade expected to be accommodated—and the extent of its dependence on the arrangements which he dictates; data which can only be obtained and appreciated by an attention to the laws to which the trade is subject.

The prosecution of these considerations will lead at once to the conclusion, that incalculable sums of money have been sunk in the improvements of this country, in reducing the irregularities of surface on works of small pretensions: That on such roads the grades ought to be comparatively steep; tunnels, deep cuts, and all similar expensive works should be avoided; and the hills and valleys, for the passage of which they are designed, should be crossed by increasing the acclivity of the grades and the length of the line. The superstructure, also, both of wood and iron, as well as the location, should be adapted to the trade; and the dimensions and weight of the engines and cars should be governed by the same considerations, and adapted to the intention of the road, and the character of the superstructure.

If the trade be great, the road must be made to correspond with it; and the foundation may then be immovable; the rails of iron, the track of great width, the acclivities gentle, the velocity slow, and the weight and power of the engines adequate to the movement of the heaviest trains. In the former case, the size of the engine might be limited to two or three tons; and in the latter, it may be extended to twenty or thirty. The cars on the light road may be made for the accommodation of eight or ten passengers; and on the other, if we choose, they may resemble moving palaces, and be provided with almost all their comforts.

All the arrangements must be subject to the control of the real or anticipated trade; and the character of the work, as well as the administration of the affairs of the line, must depend on the application of the principles which we have attempted to develope under the appellation of the "Laws of Trade." Our present study relates to the latter department—the administration of the line, in reference to the question of

The Fare for Passengers on Railroads.

The principles which have served for a guide to the results announced in the preceding articles,* are not less useful in the determination of the charges proper to be levied on railroad passengers. There are, however, difficulties to be encountered in this division of the subject, which do not always obtain in the discussion of the laws which govern the trade in heavy commodities of small value, previously considered; and which, though they cannot be thought to leave the general results at all exceptionable, may render the employment of the formulæ embarrassing in some particular applications. But yet, it is believed that by the division of the whole subject between the question which has for its object the calculation of the charges proper for particular lines, connecting important places, and the wider problem, to determine what should be the fares common to several connected railroads, that their aggregate net revenue may be the greatest possible—it will be relieved of many of its difficulties.

In reflecting on this problem, the first inquiry which presents itself is, what are the circumstances which govern an individual in deciding on the propriety of undertaking a journey? for if there be no law to which his decision is subject, there can be none to govern the charges exacted for his

* Referring to a series of articles, of which this paper will constitute one, published in the Railroad Journal for the present year.

conveyance. But, fortunately for our purpose, there is one very important consideration which, in this commercial age, appears to control all the enterprises of man in civilized society, and to the application of which there can be no exception made in favour of his traveling propensities. This is the consideration of *cost, or hope of gain.* The profits of business, curiosity, or the prospect of pleasure, incites to embark on the voyage; and the *cost of the journey*, whether it consists of the value of his time, the importance of his personal attention to his home-affairs, the desire to yield to the dictates of indolence, or the amount of his traveling expenses, urges the party to remain. He reflects on these opposite considerations, and forms his conclusions; and the result is, with very few exceptions, that he cannot afford to set out if the cost of stage *fares* will exceed a given sum. They who are to transport him have no control over any item which enters into his computation of the cost, but this; he puts his own estimate on the value of all the other considerations, and balances the account as his judgment and feelings admonish. And his final conclusion depends on the comparison of the sum which he thinks he can afford to pay for his fare, with that which the companies are disposed to exact. It matters not, for our present purpose, what this limit, which he chooses to prescribe for himself, may be—whether it amount to one dollar, or to twenty dollars—providing it be admitted that there is a sum to which each individual, after considering all the circumstances—all the charges—the advantages sought, and the inconveniences to which he will be exposed, limits the amount that he will rather pay for his fare than decline the trip.

An individual thus situated is in precisely the same condition with reference to the proposed excursion, as an article of merchandise in which he trades; there is a certain sum which may be charged for his conveyance without excluding him from the route; he will go if he is charged no more than that sum, and if charged more he will remain;—just as he will send his corn and lumber to market, if the charge for their conveyance will authorize him to do it, or retain them in his ware-house or in his forest, if the charge be higher than he can afford to pay. He makes the same sort of calculation with reference to his journey as that which he institutes in deciding on the propriety of shipping his goods.

And, if we were now able to separate the public into classes, and fix appropriate values on these classes, to represent the charges which they could afford to pay—as we can separate and value the different varieties of tonnage—the problem would be readily solved; for we would then have only to apply the equations already deduced for heavy tonnage,* to each class, by inserting in the formulæ the ascertained values of π, and obtain from them as many correct results as we should find varieties in the traveling community. But, in the present case, we cannot proceed in this way, since we are compelled, by the consitution of society, to charge all—or at least all who receive the same accommodation—alike; and consequently, before the formulæ could be employed, it would be incumbent on the company to find, among all these infinite grades, that one which, if made the basis of the tariff, would yield the highest revenue. The company do not, however, know whether the value which represents this particular grade is a constant quantity, or whether, as appears probable, it may not be a function of the distance, or otherwise complicated.

To avoid these difficulties it will be necessary to pursue a different route;

* Essay on the Laws of Trade, p. 63–5.

and assume, as authorized by the preceding remarks, that in every town on the line, or in every square mile of the country, there is a certain number of persons who can afford to make an excursion to some given point on the railroad—as the great city from which it issues—providing the cost of the trip shall not exceed a given sum. That there is another number that can afford to pay twice that amount—others three times that sum, and so on, until we arrive at the limit which would almost preclude traveling. We will also assume that the number of individuals in each of these classes is the same; or that there are three times as many who cannot afford to pay three dollars as there are of those who are unable to pay one—the number of persons excluded being directly as the sum which represents their grade; or, it may be assumed that for every increase of the cost of reaching the point in question, the number of passengers will be diminished; and that the diminution of the number will be proportional to the augmentation of the cost.

The investigation, based on these premises, will embrace two distinct cases, which appear to be the most important that are likely to be encountered in the course of the application of the principles to practical purposes. The business of the line will be assumed to be constituted either of the travel which proceeds from the large cities on the route, and which usually form the termini of the works of the separate companies; or of that which is thrown upon the main trunk by tributaries of greater or less consequence.

This discrimination is prompted by the consideration that it would seem proper for the separate companies to regulate the charges to be exacted of those who traverse their respective lines only; but that the rates to be levied on the distant traveler, who purchases his ticket and pays his fare "through," should be adjusted by the co-operation of all the parties. And the questions proposed for solution are: 1st. To determine the proper charges to be exacted of those who proceed from the cities on the line of the road, and who, for the most part, will pay over one line only; and 2d. To ascertain the law which should govern the prices to be paid by passengers who are brought to the principal route by its tributaries. These questions are too complicated to be treated without the aid of mathematical formulæ, and we will therefore designate by

π the greatest charge for conveyance which any grade of passengers can afford to pay;

ς the gross charge per mile on the railroad;

δ the freight, or actual expenses per mile per passenger on the railroad;

c the toll, or clear profit per mile per passenger on the railroad;

β the charge for conveyance, per mile, on the tributary;

h the distance from the assumed origin to the tributary.

Now, it is obviously proper to assume that if the fare on the road connecting two cities, as Philadelphia and Baltimore, were reduced to zero, and the public were carried free of charge, the number of travelers passing over the road, exclusive of those brought to the line by tributaries, would be some constant quantity, T: and it has already been assumed that for every increase of one cent in the charge, the number would be reduced some quantity represented by the co-efficient, t. The whole number of passengers proceeding from these cities will then be expressed by the equation

$$\mathrm{T} - \varsigma\, h\, t; \qquad (1)$$

since $\varsigma\, h$ is the gross charge between the two places. The clear profit

which will be derived from the transportation of this number of persons will then be represented by

$$(T - \epsilon h\, t)\, c\, h;$$

a quantity which will attain its maximum value when the condition imposed by the equation,

$$c\, h = \frac{1}{2}\left(\frac{T}{t} - \delta h\right), \qquad (2)$$

expressing the charge on each passenger, exclusive of the actual expenses, is fully satisfied.

If to this quantity we add the actual expenses, δh, we shall obtain for the proper value of the gross charge,

$$\epsilon h = \frac{1}{2}\left(\frac{T}{t} + \delta h\right). \qquad (3)$$

From which we conclude that under the circumstances assumed, the gross charge which will yield the highest revenue on all the travelers who pass between the two cities, at which they reside, will be obtained by *adding half the actual expenses to a certain constant quantity.*

The value of this quantity can readily be obtained by experiment. For this purpose we are to note the reduction of the number of passengers produced by any augmentation of the fare; from which we derive, by supposing the increase or decrease of travel proportional to the variation of the charges, the reduction caused by the whole charge $\epsilon' h$. This reduction, added to the number actually obtained under that fare, will produce the value of T; and consequently of the fraction $\frac{T}{t}$.

Now, the only objection to this argument is the assumption that the diminution of travel is proportional to the elevation of the charges on the line; a postulate which cannot be proved to be correct.

Indeed, it is probable that a given variation of the charge would produce very different values for the co-efficient t, at the extreme limits of the sums designating the elevations of the grades. But, it is to be recollected that the equation can never be applied at these limits; since in practice the charges can never descend as low as δh, or the actual expense of conveyance, nor ascend as high as the sum which would justify the establishment of a rival. The space through which the charge can possibly range, is confined within certain bounds, not very well defined, it is true, but still sufficiently restricted to destroy the chance of any material error arising from this source. And consequently within these bounds it appears safe to assume that the *increase* or *decrease* of travel (not the travel) will be proportional to the elevation or depression of the charges.

According to the form of equation (1) there is a certain charge for conveyance so high that, if exacted, passengers would be entirely excluded; and we should therefore have, $T - \epsilon h\, t = o$; from which would be immediately deduced $\frac{T}{t} = \pi$, the value of the highest grade in the community.

In fixing on the sum which represents the ability of this highest grade, if we choose to make use of this expression, we should not, of course, be governed by the occasional passenger whose wealth will authorize him to pay almost any sum for the gratification of his fancy. The expression can-

not be extended beyond the class of which the number is sufficient to contribute materially to the support of the work. It is not, however, essential to the attainment of the greatest income that the determination of this point should be very accurate; and for the object now in view—the discovery of the proper method of graduating the tariff—it is a matter of still less consequence.

In passing to the second, and more important, problem which we have proposed to investigate, we will assume that when the charges for fare, both on the main line and its tributary, are zero, the number of passengers received from each mile of the latter will be represented by any constant quantity T; and that for every increase of the whole cost of conveyance to the place of destination, amounting to a unit of price, the number of passengers will be diminished the quantity t; we shall then have, for the reduction of the number of passengers furnished by any increment of space dx, situated at the distance x from the main line, due to a charge ϵ per mile for fare on the railroad, and β on the tributary,

$$(\epsilon h + x \beta)\, t\, dx;$$

and, consequently, for the differential of the whole number supplied by the tributary, the expression

$$d\,\mathrm{N} = \mathrm{T}\, d\, x - (\epsilon\, h + x\, \beta)\, t\, dx.$$

The integral of this expression will represent the whole number of passengers, of every grade, supplied by the space consisting of x miles, measured from the main line along the tributary; and we shall therefore obtain by performing the integration, for the value of this quantity

$$\mathrm{N} = \mathrm{T}\, x - \left(\epsilon\, h\, x + \beta \frac{x^2}{2}\right) t. \qquad (4)$$

Now, the highest grade of passengers supposed to come on the work by the branch in question, as we have already seen, is $\pi = \frac{\mathrm{T}}{t}$; or the grade which renders the quantity $\mathrm{T} - \pi'\, t$ equal to zero. And if we deduct from this value of π, the whole charge for conveyance on the main line, the remainder, $\frac{\mathrm{T}}{t} - \epsilon\, h$ will stand for the sum that the portion of the community represented by π can afford to pay for conveyance on the tributary after paying the charge on the main line.

The distance which this grade can afford to travel on the tributary, will be represented by the quotient obtained in dividing this sum by the charge per mile for conveyance on the tributary—a quotient which is expressed by the equation

$$\frac{\frac{\mathrm{T}}{t} - \epsilon\, h}{\beta} = x.$$

If we now substitute this value of x in the above value of the number of passengers furnished by the tributary, we shall obtain the new equation

$$\frac{\mathrm{T}^2}{2\,\beta\, t} - \frac{\epsilon\, h\, \mathrm{T}}{\beta} + \frac{\epsilon^2\, h^2\, t}{2\,\beta} = \mathrm{N}, \qquad (5)$$

relieved of the quantity x, and completely expressing the number of tra-

velers, of all grades, destined to the assumed origin, thrown upon the railroad by the tributary under consideration. And if we now multiply this quantity by c, the toll or clear profit per mile, and substitute $\delta + c$ in place of $\mathfrak{C}$,—differentiate the expression, and place it, as required by the rule, equal to zero, we shall arrive at the condition represented by the equation

$$\frac{T^2}{3\,h^2\,t^2} - \frac{2\,T\,\delta}{3\,h\,t} + \frac{\delta^2}{3} = \left(\frac{4\,T}{3\,h\,t} - \frac{4\,\delta}{3}\right)c - c^2.$$

This is a quadratic equation, from which we obtain, after clearing it of the radical, for the toll or clear profit to be derived from each passenger,

$$C\,h = \frac{1}{3}\left(\frac{T}{t} - h\,\delta\right); \qquad (6)$$

where the charge is understood to apply to the whole distance h, through which the passenger is carried. By adding to this quantity $\delta\,h$, or the actual expense of conveyance by railroad, we shall obtain,

$$\mathfrak{C}'\,h = \frac{1}{3}\left(\frac{T}{t} + 2\,h\,\delta\right) \qquad (7)$$

for the gross charge which should be levied in order to obtain the highest dividend; an equation which again shows that *the whole charge which should be exacted of any passenger is a constant quantity augmented by two-thirds the actual expense of his conveyance.*

Although there are numerous subordinate questions connected with this problem, the two cases now examined cover the most important that can arise in the application of these principles to practical purposes. The equations resulting from the first will aid to frame the tariff on separate lines; while those of the second may be applied to lines of greater length, and constituted of a number of distinct interests.

It is not, however, necessary to make this distinction, unless there be sufficient reason to believe that the values of the fraction $\frac{T}{t}$ differ essentially for the two classes of travelers. This will be made manifest on a comparison of equations, (2) and (3) with (6) and (7); for we find by these expressions that both the toll and gross charge obtained for the two cases, are of the same form, though differing slightly in value; and that the amount of this difference is but one-sixth the whole charge—a sum entirely too trifling to produce any appreciable effect on the revenue of the work. It is not pretended here to obtain the exact charge which would yield the highest dividend, within ten or fifteen per cent.; but it is the object to point out a method by which to avoid the common errors of such tariffs—errors which are not unfrequently five, and indeed much oftener more than ten times that amount. The loss of revenue may be wholly imperceptible when the deviation from the true charge is 10 per cent.; but it must be remembered that for every dollar that is lost, on heavy tonnage, by an overcharge, or an under-charge of 10 per cent., there will be experienced a loss of one hundred dollars for ten times that deviation. *The loss increases as the square of the departure from the charge which corresponds with the maximum revenue.** It is not essential to hit the exact mark, but it is exceedingly

* *Essay on the Laws of Trade,* p. 152.—The increase is not so rapid in the present case, but it is still very great indeed.

dangerous—certain indeed to be followed by great loss—to deviate too wide from it.

Such are the equations for the computation of the rates which must be established when it is determined to enforce in practice a rigid adherence to the principles which have governed the investigation. But, before proposing a rule for general usage, it will be proper to notice a modification which may be made in the formulæ, and ascertain the probable consequences of its adoption. Occasion has already been found in the course of these articles to advert to that peculiarity of quantities which have attained a maximum or minimum limit, of being very slightly affected by a considerable increase or diminution of the value of the variable. In the question under discussion the variable which affects the amount of the revenue, is the charge for toll; and, in consequence of this property, if we increase that quantity, as determined by the calculation now offered, any small amount, although the number of passengers, of the grades that are influenced by their traveling expenses, will be simultaneously reduced, the additional tax levied on the remainder will be almost sufficient to compensate for the loss due to the decrease of the number. Now, the whole charge for toll is

$$\frac{\pi}{3} - \frac{h\,\delta}{3};$$

and if we observe the form of this quantity, we will perceive that an increase of this charge equal to the second member, $\frac{h\,\delta}{3}$, would amount, for any distance over which it would be possible, or desirable, to enter into a general arrangement, to a sum too small to produce any sensible reduction of the revenue. If, for instance, we assume six dollars for the value of $\frac{\pi}{3}$, one cent per mile for that of δ, and 500 miles for the distance h—which last assumption is nearly equivalent to supposing that the arrangement is adopted by all the companies between New York and Raleigh, N. C.,—the effect of increasing the charge per passenger as suggested, the exact value of $\frac{\delta h}{3}$, would be to increase the net income per passenger, or charge for toll at that distance, but $37\frac{1}{2}$ per cent.; while it has been shown that an increase much greater than this amount, on heavy tonnage, (Art. 2,) would not essentially reduce the revenue,—and at 300 miles the increase would be but 20 per cent., and the diminution of revenue nearly imperceptible.

We would, therefore, be authorized in permittimg such a departure from the formulæ by these considerations alone, if there existed no other argument in its favour: but it will be observed that the equation (6) was deduced in the hypothesis that every individual using the line is more or less affected by the charges; an assumption which, although in this country almost universally true, is not without exceptions—for it must be admitted that there is a portion, though a very small part, of the traveling community, scarcely influenced at all by this consideration. We have not the means of estimating the actual or comparative number belonging to this class; but there is cause to believe that the proportion which it bears to the whole number of persons traveling increases materially with the increase of distance. We also know that the effect of this modicum, if taken into the account, would be to augment the charge for toll; and, consequently, if al-

lowed for in the above expression of the net income per passenger, that equation would assume the form

$$C\,h = \frac{\pi}{3} + f\,h - \frac{\delta\,h}{3};$$

in which, as before observed, we neither know the form nor the exact value of the junction $f\,h$—nor whether it be greater or less than $\frac{\delta\,h}{3}$ — though we do know that these quantities, besides being of opposite signs, are both too small to have any serious effect on the revenue. This sum might even be a positive quantity; but, for reasons already adduced in justification of the neglect of $\frac{\delta\,h}{3}$, unless that positive quantity were one of very considerable importance, and much greater than the negative quantity $\frac{\delta\,h}{3}$, its neglect would have no visible influence on the revenue. We will, therefore, be authorized to regard these quantities as very nearly equal; and consequently neutralizing each other. The preceding equations (6) and (7) will then become

$$C\,h = \frac{\pi}{3}, \qquad (8)$$

for the value of the toll, or clear profit, per passenger, and

$$C'\,h = \frac{\pi}{3} + \delta\,h, \qquad (9)$$

for the gross charge for conveyance.

The rule which should be proposed for computing the tariff, will be drawn from the formulæ as modified by these considerations; and it may be expressed in few words—*add to the constant quantity which experiment dictates for the profit per passenger, the actual cost of his transportation*—to obtain the gross charge to be exacted for his conveyance.

The objection which may be urged against the importance of these equations, on the ground of the uncertainty which must attend any attempt to determine à priori the exact value of the constant quantity which enters them, is without force. It would be idle to expect any solution of the problem which would entirely dispense with the exercise of a discriminating judgment, or deprive experience of its usefulness. The formulæ teach us the law by which the charge must vary as the distance increases—and the only unknown quantity may be accurately determined by one or two judicious trials; without their assistance years of experience and the most accurate observation, will still leave the subject involved in the greatest uncertainty.

It will readily be perceived that, by the principles here advocated, there may sometimes be good policy in making a distinction between the different grades of travelers carried on the road; and in adapting the rates levied upon each grade to its actual ability. But, it is probable that such distinctions would be found productive of inconvenience sufficient, in this country, to limit them to two classes—the first consisting of those who regard *cheapness* as more important than the superior comforts and more select society offered in the best class of cars, and the second, of those who are willing to

pay something for these considerations. But the principles already announced for the assessment of the charges will be applicable to both these divisions;—they will each be required to pay, besides the actual cost of their conveyance, a certain tax, proportional to their respective ability, to go towards the profit of the company; and though the former part of the charge will vary with the distance, the latter part will be the same, whether the visitor to New York take the line at Baltimore, Richmond or Raleigh. The utility of such discriminations is, however, very doubtful unless made with a full appreciation of all the circumstances.

It need scarcely be said, that in fixing the charges for a long route made up of several distinct interests, an agreement between the companies composing it, to prevent injustice from being done to either, is an assumed condition. The method proposed aims for the maximum *aggregate* net income; the equitable distribution of the proceeds among the companies, will involve no difficulty, for the profits of any one line, derived from individuals who pay their fare over that line only, will, of course, belong exclusively to that company; but the profits obtained from tickets over two or more lines, will be divided among the several companies in proportion to the number of miles of travel on them respectively.

It may also be observed that the application of the system is not to be extended to roads so short that the quantity representing the profits would be such as to justify the establishment of a rival. The actual value of this constant must first be ascertained and applied to the distant travel; and if it amount to a higher sum than it would be deemed advisable to charge on the separate roads, or than their charters would permit them to exact, they would be at liberty to make the needful modifications. The regulations adopted on the lines taken separately, would be independent of those which would be applicable to the common interest.

It is not denied that there are plausible objections to the process which has conducted to the conclusions presented in this paper; and that it may not possess all the accuracy that is sometimes attainable in similar researches. But it does, nevertheless, seem to be the nearest approach to a rigorous solution of which the important, but complicated, problem is really susceptible.

Withal, the simplicity of the result adapts it peculiarly for general use, and renders its application exceedingly easy on the longest and most complicated lines. It is offered as an attempt to elucidate a subject which seems not yet to have occupied the attention of the profession, or of railroad companies—but which possesses the highest interest, both as a question of profit, affecting the dividends due to the greatest investment of capital ever made for any one object of public improvement; and as a question of political economy, involving the measure of the benefit to be derived from the railroad system.

Franklin Institute.

Appendix to the Report of the Committee on Premiums and Exhibitions on the 11th Exhibition of Domestic Manufactures held by the Franklin Institute.

Report of the Committee of Judges on Cotton Goods.

To the Committee on Premiums, &c. of the Franklin Institute.

Your Committee on Cotton Goods have examined the several specimens submitted to their inspection, and respectfully report thereon as follows:

No. 249.—3-4 undressed chintz prints, from the American Print Works. These are highly creditable to the manufacturers—are printed with great care, and exhibit superior workmanship.

3-4 Fall River chintz prints—a good article, and well supports the established reputation of that manufactory.

No. 939.—3-4 black ground prints, printed by Marshall & Co., New York, highly commendable; the ground colouring very clear and perfect, and the shading and printing very accurate.

No. 818.—3-4 chintz prints, from the Taunton Print Works, a very beautiful and chaste style, reflecting great credit on the manufactory. These goods are conspicuous for the neatness and taste displayed in the patterns. The work generally well executed, although a few slight inaccuracies are observable in the printing.

3-4 Merrimack dark chintz prints. These goods well sustain the character which this manufactory has so long enjoyed for producing good work.

No. 629.—6 pieces 4-4 chintz prints, printed by J. Dunnell & Co. These goods are of superior excellence, colours and finish very good—printing, consisting of several colours, unusually perfect, style beautiful. Your committee consider these prints the best exhibited, and think they merit special notice.

3-4 chintz furniture prints, from the Fall River Works, a rich and beautiful article, of good style and perfect work—these rival the imported.

Power loom ginghams, made by James C. Kempton, said to be the first goods ever wrought by 3 shuttles in Power Loom—the entire execution of these goods, including dyeing, is very superior. Your committee believe that in England they have long endeavoured to invent machinery to weave checks and plaids by Power Loom, without success, and would suggest that the invention should be suitably noticed.

Power Loom checks also made by James C. Kempton. The above observations apply to these goods, as similar machinery is employed in manufacturing them.

No. 257.—White cotton counterpanes, a substantial and handsome article, highly creditable to the manufacturer—large quantities of the foreign fabric are consumed. For the manufacturing of these goods a great weight of the raw material is required, on which account your committee are of opinion that this branch of manufactures should be encouraged.

No. 219.—4-4 coloured rolled Silesias, good cloths and colours; a fair specimen of an article now much used for linings, as a substitute for the imported.

No. 879.—Cotton yarn No. 80, from the Rockland Manufacturing Com-

pany, a beautiful specimen of fine yarn. Your committee not being conversant with the state of the manufacture of this article, deem it proper to say so, that the manufacturer may not be deprived of his deserts by reason of their imperfect knowledge.

Nankeens and Chambrays, made from the natural coloured Georgia cotton—the former of these articles has become one of general use for men's and boy's wear, and is very serviceable for its durability of texture and colour.

No. 290.—Shoe thread, made by Smith, Dove & Co., Andover, Massachusetts, an excellent article, strong, and of uniform fineness, apparently fully equal to the imported—the "putting up" exactly resembles the foreign article, of which large quantities are annually consumed.

No. 674.—Cotton and woolen hose, shirts and drawers, made by John Hopkins; very good samples of these very useful articles, of fair texture, and for durability and service, at least equal to the imported. As yet the manufacturing of these articles at home is not extensive.

Samples of bleached shirtings, from several manufactories, were exhibited, of superior quality. The market has long been supplied with this description of goods, of so excellent a character, and at so low a price as almost entirely to exclude the foreign article.

Sundry samples of ticks, checks, plaids, Canton flannels, paper muslins, white and coloured cambrics, cotton handkerchiefs, and shawls, suspenders, &c., were exhibited; all excellent in themselves, and for which description of goods the trade has long depended almost exclusively on the domestic manufacturer.

Before closing this report your committee would remark that the variety of cotton goods exhibited at this time is not so great as on former occasions; this is to be attributed to the fact that many articles which formerly were novelties, have, owing to the increase in their production, ceased to be so, and are no longer thought to be objects for exhibition—another reason is, that manufacturers, who are preparing new articles intended for sale the coming season, are naturally averse to expose to the view of competitors specimens which might be copied to their own pecuniary disadvantage. It is believed that no article belonging to our department was manufactured with a view to be exhibited, but that all were gathered from warehouses, which contain packages of the same goods for sale. At the present period the assortments are much broken, and consequently unfavourable for obtaining samples for exhibition. Your committee, in conclusion, think that the vast and rapid improvement and increase in the manufacturing of cotton goods, affords ample cause for congratulation.

Philadelphia, Oct. 19*th*, 1840.

Report of the Committee of Judges on Iron and Steel.

The Committee appointed by the Franklin Institute of Pennsylvania, for the purpose of examining sundry specimens of iron and steel, respectfully report that they have attended to the duty assigned them, and having examined the specimens as well as circumstances would permit, proceed to give their opinions of the several articles submitted to them, viz.

No. 418.—A lot of anthracite pig iron, deposited by W. R. Johnson.

No. 753.—Anthracite pig iron, made by Baughman, Guiteau & Co.

Also samples of pig iron made by Biddle, Chambers & Co., deposited

by Morris & Jones. The metal in both samples of anthracite iron, appears to be of various qualities, and gives us every reason to suppose that iron may be made with anthracite of as good quality as the iron made with Bituminous coal.

The samples from Biddle & Chambers, appears to be well adapted to foundry purposes.

No. 494.—Castings by Levi Morris & Co., from anthracite iron, particularly two fine heads, similar to the Berlin castings, and exceedingly well done; also some other specimens by the same gentlemen, that are very creditable to them, and evincing improvement in this very important branch of the arts.

No. 581.—Samples of iron deposited by Morris & Jones, viz. 3 sheets of boiler iron, of unusually large dimensions, one of them is 10 feet 6 inches in length by 31 inches broad, made from charcoal blooms, in the usual way by Yearsley & Forsyth, made at one heat for each sheet, and very handsomely rolled; the quality of the iron is said to be very good.

Four samples of iron made from charcoal pig metal, puddled with wood and anthracite. This iron is of good quality, made by Betolett and Co.

One sample of iron from charcoal pig metal, puddled with Bituminous coal, by Keim, Whitaker & Co.—the appearance of this iron is good.

One piece of iron from charcoal hot blast, pig metal, made by the run out process, at Coleman's Iron Works, Mastic Forge, Lancaster county, and is of a superior quality.

One piece of round iron from anthracite pig metal, from the Crane Iron Works, made into bar iron at the Boontiss works, with anthracite coal.—This iron is of good quality, and deserves to be particularly noticed, as it goes to establish the fact that good iron may be made with anthracite coal exclusively, and also with a great saving both of metal and fuel; it is stated by the maker that the whole waste of metal during the conversion does not exceed 12 per cent. Such facts, we think, are very encouraging to those engaged in making these experiments.

No. 579.—Several specimens of iron, deposited by E. J. Etting & Brothers, made by Valentine, Thomas & Co., at the Bellefonte & Juniata Iron Works. This iron is very well made, and appears fully to sustain the reputation it acquired at the last exhibition.

Two samples of iron from the Howard pig metal, made by Valentine, Harris & Co., deposited by Etting & Brothers. The character of the iron made from this metal is so well known that it does not require any recommendation.

No. 708.—One card of spikes and 2 horse shoes, made by the Troy Manufacturing Co., by Henry Burden. Also one card from the Albany Iron and Nail Works, at Troy, by J. F. Winslow. Both samples are made by machinery, and are very handsome articles—there appears to be so little difference in them that we would decline recommending one in preference to the other.

No. 487.—Four sulkey backings, made by G. E. Dunn, of Newark, N. J., which are considered very fine specimens of smith work.

No. 495.—Three bars of steel from American iron, converted by J. Robbins, Jr.; it is not superior to some that has been brought forward at former exhibitions. Also 2 or 3 bars from the same maker,—a very good article,—the committee, however, are not certain that it is made from American iron, as it is not stated by the depositor whether the iron is Domestic or foreign.

Philadelphia, Oct. 20th, 1840.

Report of the Committee of Judges on Musical Instruments.

The Committee on Musical Instruments Report:

In deciding on the merits of the twenty-one piano fortes which were exhibited in competition, the committee have had special reference to the following particulars:—

1. The tone; its clearness, purity, sweetness, force, brilliancy, equality throughout the scale.
2. The touch.
3. The action, including dampers, &c.
4. The structure of the instrument, its durability, its power to stand in tune, the facility of tuning and repairing it; involving the proportion and arrangement of its parts, the mechanical execution, materials, &c.
5. Economy of construction, in combination with other particulars.

External appearance was regarded as an independent consideration, not immediately affecting the technical excellence of the instrument.

In comparing the tone of the instruments, each was in the first instance fully tried by at least three performers, in the presence of the committee, and a few were marked by their unanimous decision, as decidedly inferior to the rest in this particular. When two or more of the remaining instruments were presented from the same workshop, the best of them was next fixed upon after renewed trials. The competitors for the first rank, thus ascertained, were again tried repeatedly, and the number gradually narrowed down by comparisons. Of the few that remained, after numerous and varied trials, the instruments having been brought together and placed in circumstances altogether similar, a selection was made by secret ballot; and to ensure as far as practicable an unbiassed decision, care was taken to avoid all prior communication of sentiment between the members of the committee.

The character of the touch was next determined by the members of the committee, who are performers; and as they concurred in opinion, the committee proceeded to inspect the action of the instruments. For this purpose, one instrument at least from each establishment, including every supposed variety, was opened, the action taken out, and every part of it examined in comparison with the others. At the same time, the entire structure of the instrument was judged of, with a view to its fitness and strength, and with reference also to its economy; the committee being of opinion, that of two instruments in other respects equal, a preference should be given to the one which had been produced by the smallest expenditure, and could be sold therefore at the lowest price.

The committee are unanimously of opinion that of all the instruments exhibited, the highest praise is due to one of six octaves, made by Brown & Hallett, of Boston. It is a very small instrument, the smallest indeed in the whole collection; but its tone is superior to any other in the particulars which constitute excellence. The touch, though not better than that of some others, is good. Its action differs but little from the most approved English action; it is neat and very well made, though except in the working parts, it is not so highly finished as several that are in the room. Its arrangement is convenient; it appears to have adequate strength, and the mechanical execution is altogether workmanlike. The disposition of the soft pedal, denominated by the makers, "new patent," avoids the necessity of shifting the action, and is remarkable for its simplicity and durability,

and for the extreme beauty with which it gives the monochord tone. It has, moreover, the recommendation of being a cheap instrument. In exterior appearance it is plain.

The piano next in rank, according to the judgment of the committee, is one of six and a half octaves, from the New York Manufacturing Company, No. 268, (exhibition No. 399,) except in the character of its soft pedal, this instrument approaches closely to that first spoken of, and was a powerful competitor for equal honour.

Of the other excellent instruments presented, the committee would specially notice those from the establishments of Thomas Loud, of Philadelphia, and Chickering & Mackay, of Boston. One of Mr. Loud's, in rose wood, of six and a half octaves, No. 2237, is remarkable in a very high degree for its admirable touch, its brilliant tone, its fine mechanical execution, and its apparent strength and ability to stand in tune. Those of Messrs. Chickering & Mackay, in rose wood and mahogany, have the characteristic excellence of the instruments from their establishment. A very highly finished instrument by Messrs. Bossert & Schumacker, of Philadelphia, (No. 420, examined,) should also be remarked for the finished mechanical execution of the internal parts, and the beautiful workmanship of the case.

A number of excellent flutes were submitted by Mr. Pfaff, and Mr. Weygandt, manufacturers, of Philadelphia. The preference of the committee is expressed in favour of those made by Mr. Pfaff, on Monzani's patent, on account of the superior accuracy of their scale, the quality of their tone, and the convenient structure of the keys. A flute, made by the union of successive layers of linen or cotton drawn tight over a mandril, also attracted notice as a highly finished instrument; but the peculiar advantages of its structure were not explained; the maker is Mr. Catlin, of Philadelphia.

A brass clarionett, E. Flat, by Mr. Pfaff, is a very highly finished instrument, and its clearness of tone would seem to fit it well for a place in a military band.

Mr. O. M. Coleman, of Philadelphia, submitted his Eolian lute, a beautiful and graceful instrument of his own invention and manufacture. It is in principle a double accordion, but the facility with which it ascends and descends the scale, the certainty of its tone, and its power of combinations, as well as its lute like form, properly claim for it a different designation.

The automaton minstrel of the same gentleman, and a parlour organ, by Mr. Knauff, arrived at the hall of exhibition so late as to preclude an examination of them by the committee.

Report of the Committee of Judges on Bookbinders' Work and Tools.

The Committee on bookbinders' work and tools, respectfully report, that they have examined very carefully the various articles enumerated in the annexed catalogue, and deem it necessary only to report specially upon those hereinafter set forth—the rest, in their opinion, require no particular notice; they are fair specimens of work, but are distinguished by no peculiar claim.

No. 31, by Abel & Pomeroy.—Specimens of bookbinders' work, exhibiting good workmanship and finish, and evidence of the general improvement of this branch of manufacture.

Nos. 22, 23, 24, by A. C. Morin, 29, by Gaskill & Copper, and 74, by

C. W. Lang.—Specimens of bookbinders' stamps, tools, and embossing plates, very creditable to the makers.

No. 40, by Lindsay & Co.—Many specimens of bookbinder's work, including volumes in quarto, the whole of excellent workmanship, and the best specimens of binding for general use that have ever been exhibited in this city. It is proper to remark, that the books were not bound for exhibition, but were the current work of the bindery of the exhibitors, who are entitled to the highest commendation for the perfection to which they have attained in their art.

No. 305, by Gaskill & Copper.—Bookbinders' tools. These are deemed the best specimens ever exhibited in this city, and are equal to the best of specimens of English workmanship.

No. 463, by Samuel Moore.—A single copy of Lalla Rookh, a specimen of binding of superior excellence, and the best bound single volume in the exhibition.

Philadelphia, Oct. 19th, 1840.

John C. Cresson,
Alexander Dallas Bache,
Alexander Ferguson,
Thomas Fletcher,
Isaac B. Garrigues,
John S. Warner,
John Agnew,
Thomas U. Walter,
John Struthers,
John H. Towne,
Committee on Premiums and Exhibitions.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1839,
With Remarks and Exemplifications by the Editor.

1. For an improved *Double Catch Bolt Lock;* Conrad Liebrich, city of Philadelphia, October 5.

These improvements are applicable "to all those locks which have double catch bolts, to lay hold on two sides of a hasp, or staple." The particular devices by which it is intended to afford additional security, are not of a kind to be understood without the drawing in which they are represented, and to which the claims refer.

2. For an improved mode of *Converting a Rotary into a Reciprocating Motion*; Christian Wilson, Bedford, West Chester county, New York, October 5.

It appears that a principal object of this invention is to work the dashers of churns. For this purpose a weight suspended by a rope acts upon an axle on which the rope is wound; and this, by cog gearing, gives motion to a pendulum, from which a connecting rod extends to a bell crank, to which a dasher, &c. may be applied. The whole affair is not worth the trouble of description, as it does not present any thing new in principle, and the right under the patent can extend only to the special arrangement given.

3. For a *Mould Board for a Plough;* Samuel Witherow, of Gettysburg, and David Peirce, of Philadelphia, in the state of Pennsylvania, October 5. (See Specification in vol. xxv. p. 113.)

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4. For a *Black Pigment;* Nathaniel Chater, city of New York, October 5. (See Specification.)

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5. For a *Molasses Gate;* Jervice Whittemore, city of Boston, Massachusetts, October 9.

In this molasses gate a tube enters the barrel in the usual way, and is furnished at its outer end with a sliding gate to close the aperture, but this gate, instead of consisting of a flat piece of metal, forms a segment of a circle, of four inches radius, the plate, or tablet upon which it bears being of the same degree of curvature. A steel spring proceeds from the opposite sides of the tube, and these springs work upon joint pins at their back ends, and are bent round in front so as to bear upon the sliding gate, and keep it in close contact with its seat, or tablet. The gate is operated by means of a rack and pinion.

The claims are "to the mode of arranging the springs for keeping the gate firm in its seat, by attaching them to the sides of the socket, upon the tube, and making them movable upon it as a centre, and conducting them along said tube, and securing them to the centre of the gate as above described. And in combination therewith, and necessary thereto, making the tablet and gate of a curvilineal shape; the tablet forming a segment of an arch, so as to allow of the radial steel springs describing a motion on their pivots."

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6. For a *Plough for Prairie Lands;* Josiah Dutcher, city of New York, October 9.

The claim under this patent is, first, to "the manner of constructing the share, by forming it of a wide flat plate, with two or more rows of holes for attaching it to the mould board, for the purpose of shifting it forward as it wears, and with the fore end of said plate turned up as described, so as to form a cutting edge, whilst its plane coincides with, and forms a part of, the mould board. Also the manner of sustaining the front part of the share by placing its vertical portion between the centre and the flanch cast upon the mould board, and by passing a bolt through the whole, as set forth; also the projecting piece, or stop, bearing against the heel of the plough, for the purpose of sustaining the back end of the share."

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7. For a *White Cement, or Artificial Stone;* John D. Greenwood, and Richard W. Keene, Great Britain, October 9.
(See Specification.)

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8. For an improvement in *Hanging Carriage Bodies;* Azima Vallerchamp, McDowellsville, Columbia county, Pennsylvania, October 12.

"The nature of this invention and improvement consists in a certain new and useful combination and arrangement of springs fastened to the perch of the carriage, and straps and buckles attached to said springs, and to the under side of the carriage body when arranged in a pendulous, or self balancing manner, on the elliptic or other springs, for preventing the body swinging too far transversely; the longitudinal swinging being prevented

by straps attached to the front and hind ends of the carriage body, and to the upper side of the perch."

The claim is to the combination and arrangement of the springs and straps, as indicated in the above extract from the specification. The straps are, in fact, check straps, and do not present any great novelty, though enough, it seems, to justify the grant of a patent.

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9. For an improved *Smut Machine;* John B. Yates, Sperryville, Rappahannock county, Virginia, October 12.

A vertical cylinder of cast iron, is to have the interior of its sides fluted from top to bottom, and its bottom is also fluted or divided into ridges, like a mill stone. To this cylinder there is to be a top, through a hole in which the grain is to be admitted; as it falls down it is struck forcibly by revolving beaters, which force it against the tooth-like flutes at the sides, and rub it, in some degree, against them and on the bottom. Through an opening in the bottom, it passes to a cleaning apparatus. The claim is to the before described beaters constructed with horizontal wings at their bottom, in combination with the fluted cylinder as described."

By those familiar with this subject it will be seen that this machine differs but little from several which have preceded it. The form of the beaters is, in fact, the only peculiarity, and this difference is, literally, rather in form than in substance; the office is sometimes blamed for granting such patents, but in general, unjustly, as where the identity of two things is a disputable point, it is the duty of the office to leave the matter to the courts.

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10. For an improvement in the *Ever-pointed Pencil Case;* Jacob Stockman, and Samuel W. Hopper, Assignees of W. Simons, Philadelphia, October 12.

In an article like the ever-pointed pencil case, which is composed of several distinct tubes, and other parts, combined together, the peculiarities upon which any new claim rests cannot be understood without a full representation of the whole; all that we can offer in the present instance, therefore, respecting the article before us, which is a very neat one, and does not appear to be liable to get out of order, is as follows. The point is protruded by drawing out and returning a tube at the lower end of the case, and is returned to its place by a similar movement; resembling that of Lowndes' case, which is operated on at the cap, or upper end. The inventor says that "by this arrangement of the several parts of the pencil case, it is simplified in its construction, the friction is lessened, and there is little liability of its getting out of order. The derangement consequent upon giving the requisite motions by the screw cap of the pencil is also avoided." The claim is to the particular arrangement, as set forth.

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11. For an improved *Hub and Axle for Carriage Wheels;* John Loudon, Aubern, Cayuga county, New York, October 12.

The patentee says, "I make the hubs, or naves, of my wheels of cast iron, or of any other suitable metal, and bore out the cavity which is to form the box for the reception of the arms of the axle, from the inner end thereof, leaving the outer end solid in that part where the nuts and caps which confine the axles and boxes together, are usually applied. The screw collar or cap, which I employ for that purpose, being situated at the inner end of the hub." The screw collar which is used is divided into two parts, and has a male screw cut upon it which screws into the rear end of the hub. A

recess in the axle constitutes an oil box, and there is an elastic packing to prevent the escape of the lubricating material.

There is considerable resemblance between this manner of making the hub and axle, and that which was patented by Mr. Delano, between whom and Mr. Loudon there was some dispute respecting the invention; it is believed, however, that there has not been any interference between the two, legally established.

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12. For a *Machine for Planting Corn;* N. R. and O. G. Merchant, Guilford, Chenango county, New York, October 12.

There is but little difference between this machine and a number of others already in use; the only claim made is to "the manner of varying the distance of dropping the seeds by changing the lever to different rows of cogs in the hub, as described." It is not worth while to give a long account of the particular device adopted in the present case, as it does not appear to present any special advantage over other plans for effecting the same purpose.

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13. For improved instruments for *Manufacturing Barrels, Kegs, &c.;* William G. Burr, Mount Pleasant, Westchester county, New York, October 12.

The claims under this patent will afford a good general idea of the nature of the things invented, and are as follows:

"*First.* The manner of constructing the instruments for turning and champfering the heads of such vessels. Said instrument consisting of the forked lever, carrying the three cutters, and being held down upon the rest by a holdfast and weighted lever, formed and operating as set forth.

"*Secondly.* I claim the apparatus for centering and holding such vessels whilst being turned; said apparatus consisting of a mandrel, with jointed arms, operated upon by sliding wedges, which are forced forward and retracted by means of a band and pulleys, or by means of screws, or other known mechanical devices producing a like effect.

"*Thirdly.* I claim the within described instruments for turning or truing the ends of the staves, and for performing the operations of beveling, howeling, and crozing the barrel or other vessel; the respective cutters for that purpose being attached to a cutter bearer, in the manner set forth."

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14. For machinery for *Reeling, Spinning, and Twisting Silk;* Jacob Pratt, Sherburn, Middlesex county, Massachusetts, October 12.

This machinery, as represented in the drawing, embraces the whole apparatus for performing the above named operations; but its construction is, in general, similar to such as is well known, and is not claimed as new, the claim being limited to the "using a trough of zinc, partially filled with warm water, in which are arranged the spools from which the raw material is to be wound for spinning." The object of keeping the spools so immersed is stated to be "to keep the fibres from adhering to each other or the bobbins, by keeping the gelatinous substance in a state of solution." No particular reason is given for making the troughs of *zinc*, and we suppose that copper would do equally well; but from the special mention of this metal we were led to look for some ground of preference to it.

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15. For *Hanging Carriage Bodies;* Dimon B. Barnum, New Fairfield, Fairfield county, Massachusetts, October 16.

This is a very simple contrivance, not having much claim to novelty, and, we apprehend, not very likely to produce much litigation on account of its value. The carriage body is to rest upon spiral springs coiled vertically around a shaft. This arrangement affords vertical, but does not allow of any lateral, motion.

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16. For a *Mowing Machine;* A. P. Trask, and D. Aldrich, Ellington, Chautauque county, New York, October 16.

The claim made is to the "placing the two front wheels on which the mowing machine moves, within the wheel of scythes, as described; and also the revolving rake for laying the grain in gavels, regulated in its action by the arrangement of the rods and wires, as described, in combination with the wheel of scythes."

In the general construction of this machine, so far as the cutting by means of scythes arranged around the periphery of a wheel revolving horizontally, near the ground, is concerned, it does not present any thing that is new; the claim is, therefore, confined to the details above pointed out, which may probably be productive of some advantage.

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17. For improved *Metallic Stop Cocks;* Ari Davis, city of Boston, state of Massachusetts, October 16.

This is, we believe, an entirely new and a good mode of making a stop cock for gas, and for other purposes. It is not furnished with a key the plug of which passes through the bore of the body of the cock, but with one which has an appearance like the head of such a key cut off from its conical portion. The opening through the cock is bored in from each end, leaving a solid portion in the middle, or the bulb portion thereof. The bore then turns up at right angles, forming two openings on the top of the cock. The key, which is flat on its under side, covers these openings, and has a chamber in its head, which affords a passage to a fluid when turned in one direction, but cuts it off when turned a quarter round. Between the flat bottom of the key, and the top of the cock, there is a piece of leather, or other suitable substance, interposed. The key is held down by a small screw bolt passing into its centre, and through the body of the cock, between the two apertures bored into it.

The claim is to "the mode of arranging the canal, by carrying it up after it reaches the bulb, then into the head of the key, and down again on the opposite side into the bulb, as described."

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18. For an improvement in *Circular Saws;* Jonathan Gove, Fayetteville, Cumberland county, North Carolina, October 16.

(See Specification.)

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19. For a *Smut Machine;* Leonard Smith, Plattsburg, Clinton county, New York, October 18.

We are hoping for a truce in the examination of smut machines, which have become very numerous, whilst many of them appear like twin brothers, so much alike as to require a very intimate acquaintance with them to recognize their individuality at first sight. We shall, in the present case, give no further description of the above named machine, than that afforded by the claim, which claim would answer equally well for half a dozen different members of the same family.

"What I claim as my invention, and wish to secure by letters patent, is the combination of the beaters with the fans, grates, and heads, constructed and operating as described."

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20. For *Protecting Iron from Oxidation;* Palmer Sumner, and Peter Naylor, city of New York, October 18. (See specification.)

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21. For a *Smut Machine;* Luther B. Walker, Orangeville, Genesee county, New York, October 18.

The claim is to "the constructing of smut machines with internal beaters, having curved plates, or wings, as described; and in combination with the above, the discharging tubes, or spouts, also as described." There is something more special in the arrangement of this machine than in many others for the same purpose, but the peculiarities could only be made known by a longer story than we are disposed to tell, unless we were aided by engravings.

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22. For a *Re-action Water Wheel;* Timothy Rose, Windsor, Broome county, New York, October 18.

This re-action wheel, which is similar in its general construction to those that have been most extensively used, in which the water is admitted on one face of the wheel, and is discharged at its periphery through a series of openings between overlapping curved buckets, in a direction tangential to the wheel. The improvement consists merely in making the head of the wheel at which the water is admitted larger than the lower or back head, so that its periphery will form the frustum of a cone. The patentee avers that he has "experimentally proved that the power of such a wheel is much increased by giving to it this form," and claims "the making the buckets to flare out from the back, or bottom plate, to the rim, or face, so as to enlarge the openings of the latter, in the manner set forth."

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23. For a *Wheel for Railroad Cars;* David Cockley, city of Lancaster, Pennsylvania, October 21.

This wheel the patentee calls a "single plate and bracket wheel." Instead of spokes, or arms, it has a single concavo-convex plate joining the nave and rim, and this is strengthened by brackets, which on the convex side of the plate bear against it and the rim, and on the concave side, against the plate and the nave, or hub.

The claims are to "the employment of brackets on the back, or convex side, to support the rim; and also the additional length of the hub, with a bore sufficient to receive the axle of its full size, as a safety in case of the axle breaking at the shoulder, also as described." The additional length spoken of is made by extending the back of the hub so as to cause it to surround the larger portion of the axle, behind the shoulder, which, however, it does not touch. The additional safety from this device is not very apparent, and certainly is not great.

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24. For a *Spark Arrester;* William Knight, Chambersburg, Franklin county, Pennsylvania, October 26.

The chimney in which the sparks are to be arrested consists of two tubes one within the other, the inner tube being perforated, through its whole length, with numerous small holes, or it may be made principally of wire gauze. The two tubes are connected at top by a rim which incloses the

space between them, whilst the interior tube is left open. This inner tube is closed at the bottom, excepting for the admission of the exhaust steam pipes, which discharge through it. The direct draught from the fire is between the two tubes; and from this space it must pass through the perforated tube, in order to escape at the top of the chimney.

The claim is to "the perforated tube extending the whole length, or a considerable portion of the length, of the smoke pipe, and having its lower end closed, excepting the apertures for the admission of the tubes through which the exhaust steam from the cylinders are admitted to pass into it."

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25. For an improvement in the *Piano Forte Action;* Hiram Herrick, city of New York, October 26.

This is a matter but little understood, excepting by those who are piano forte makers, and the variations in the action of these instruments are numerous; that which is the subject of the present patent appears to possess some mechanical advantage, which, however, cannot be fully made known without drawings. The claim is to "the manner in which I have arranged the fly, or jack, in reference to the hammer butt, so that by the depression of the key, said fly, or jack, shall approach the forward end of the hammer butt, and finally escape in front of it."

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26. For an improvement in the machine for *Mitreing and Dovetailing Boards and Plank:* Richard Urann, city of Boston, Massachusetts, October 26.

A patent was obtained by Mr. Ari Davis, for a machine by which the mitreing and dovetailing were effected by circular saws; this patent was obtained on the 31st of August, and was noticed in its proper place. The machine patented by Mr. Urann is very similar to this, but in the claim to his patent, Mr. Urann says that his "improvements consist entirely in dispensing with the use of saws, and effecting the whole object by means of cutters, in the manner set forth; I therefore claim as my improvement, the employment on the same disk, of the cutter for cutting the mitre on the end of the board, and another for one half of the dovetail, or groove, in combination with cutters on the second disk for completing the said dovetailed tongue, or groove; the whole operating substantially as described."

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27. For *Hanging Carriage Bodies;* Ira W. Britton, Medina, Medina county, Ohio, October 26.

In the specification of this patent, the patentee refers to the description of a rolling wagon reach described in Newton's London Journal, vol. xiii, p. 139, and vol. xiv, p. 121, of the first series; his invention being confined to the rocker joint only, which is to be added to the rolling reach above referred to. The rocker joint is a bar of iron, which is placed on the upper part of an elliptical spring, and works on a joint pin on its centre. The object is said to be "to prevent all straining or twisting of the springs and boxes, or bodies, of four wheeled carriages, when passing over uneven ground."

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28. For a machine for *Boring Timber:* R. Hubbell, assignee of Moses Hubbell, Hudson, Portage county, Ohio, October 26.

"The nature of my invention consists in having a portable machine running upon trundle wheels, by the side of the timber to be bored, with a crank and fly wheel for the augers, and appropriate machinery to gauge,

elevate, and depress the auger, and to throw it back after having penetrated the timber." After this announcement, there are six large pages of description, making known the particular arrangements adopted by the patentee; and this is terminated by the claim to "the combination of the carriage for setting the auger at a proper height, and giving it a proper direction, with the slide containing the auger; the whole being applied to a portable frame, for the purpose, and in the manner described."

A machine of this kind may be constructed and modified in so many ways, without interfering with any of the special arrangements described in this specification, as to render such a patent of but little value, however ingeniously the machine may be constructed.

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29. For a new and improved *System of Music:* Thomas Harrison, Springfield, Clark county, Ohio, October 26.

The claim under this patent is to "the placing of the first seven numerals between, and over, and under, two parallel lines, thereby instituting three successive octaves, and affixing periods, commas, and hyphens, to the said numerals, in order to determine their relative length."

Whenever we see half a dozen pieces of music published upon this plan, we shall think it worth while to give some analysis of it, but as we do not expect ever to witness this, our readers will scarcely have their attention again called to this matter. Many ingenious attempts have been made to introduce new notations in music, but they have been still born.

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30. For *Clearing Snow and Ice from Railroads;* Thomas S. Ridgway, Pottsville, Schuylkill county, Pennsylvania, October 31.

The plan proposed of effecting the clearing of snow from rails consists of two principal devices. The first of these is the having heated air, or flame, forced on the tops of the rails in front of the wheels of a locomotive engine whilst running, in order to melt the snow and ice that may lay upon said rails. To effect this, there is a revolving fan wheel placed in a box appropriated to it, and situated against the front part of the smoke box; and from this fan wheel the sparks and heated air from the fire are to be directed on to the respective rails, through tubes fixed for that purpose; by which means the ice and snow are to be melted, and the rails dried.

The second device consists mainly of two heavy, cast-iron wheels, one for each rail, having an axletree, and so placed as to be pushed before the engine, and to cut the ice by means of their weight. These wheels have a number of wrought-iron teeth, with steel edges, inserted into their peripheries.

The claim is to "the forcing of hot air, sparks, &c., in the manner herein described, upon the rails of a railroad, for the purpose of melting the snow and ice that may lie upon them, and drying the rails when wet. Also the accompanying ice cutters, as described."

To us these means appear so inadequate to the production of the end proposed, that we are a little surprised at its adoption by a gentleman of intelligence. We may err in judgment in this matter, but we really cannot believe that all the heated air that could be thrown upon the two rails, from a locomotive furnace, would melt the ice and snow, when of a moderate depth only, at the rate of a mile in an hour.

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31. For a *Corn Sheller;* Samuel H. Kissinger, and E. G. W. Stake, Williamsport, Washington county, Maryland, October 31.

This corn sheller resembles that which was the first patented machine for the same purpose, in which the corn was shelled by means of a revolving cylinder, set with points, or teeth, and operating against an elastic concave. The improvements are indicated in the following claim.

"I do not claim to be the first to have invented an apparatus for shelling corn by means of a revolving cylinder set with teeth, this having been done in many other machines; but what I do claim as of my invention in the above described machine, is the manner in which I set the teeth in my cylinder, in combination with the double inclined plane, and with the two springs, constructed and operating in such a way as that two ears of corn fed in at the same time will be shelled, and the two cobs carried out at the opposite side of the machine."

The cylinder revolves horizontally, and the teeth are so set upon it as to tend to carry the ears, which are dropped in near to its middle, towards either end, where the cobs are delivered. The inclined planes are two boards which support the ears, and along which they descend, whilst pressed by two springs against the cylinder.

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32. For a machine for *Removing Stones, &c., from deep water*; Philander Lee, Syme, Jefferson county, New York, October 31.

"My machine consists of two pieces of timber about eight inches square, and four feet in length; these are fastened together at one of their ends, whilst their other ends are separate about four feet from each other. These timbers are firmly secured in their places by bars of iron passing diagonally from one timber to the other in such manner as to constitute an apron, or platform, upon which the bodies to be removed are usually drawn. Into the upper surface of the frame are inserted teeth, or bolts of iron, about one foot in length, and placed so near each other as to retain any bodies placed thereon during the removal."

Two tug chains are fixed to this apparatus, and these are connected by other chains crossing from one to the other, and forming a flexible apron in front of the inflexible part of the drag. By means of these chains, or of ropes attached to them, leading to windlasses properly stationed, the drag is to be drawn along on the bottom of the water.

The claim is to "the combination of the flexible apron, or net work, with the wooden frame, or platform, provided with teeth, &c., as herein described."

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33. For *Carriage Springs*; Sumner King, Suffield, Hartford county, Connecticut, October 31.

"The nature of this invention consists in making the leaves of springs convex or concave, transversely, instead of flat; by which formation they are rendered much stronger than the common springs. The greatest convexity, or concavity, is in the centre, and decreases gradually towards the ends, where the leaves are made flat for a proper union of the same." The claim is to the foregoing manner of forming the leaves.

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34. For a *Machine for Rolling Leather;* William Coburn, Mountjoy, Lancaster county, Pennsylvania, October 31.

"What I claim and desire to secure by letters patent, is the constructing a table having a concavity on its surface which is the segment of a hollow sphere adapted to the vertical sweep and roller, as herein described, by

means of which the roller may be passed over the leather in all directions, without the necessity of shifting the place of said leather.

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35. For an improvement in *Piano Fortes;* Alpheus Babcock, city of Boston, assigned to J. Chickering and J. Mackey, October 31.

This improvement is confined to that part of a Piano Forte action which is denominated the jack, or grasshopper, and the things claimed are the following: "Attaching the regulating screw to the fly, and making it movable with the same, instead of connecting it to the jack, as has hitherto been the case; and also in combination therewith, and as necessary to the operation of the same, the arrangement of the damper upon the inner end of the regulating screw, and the attaching of a pad, or cushion, to the inside of the jack, so as to deaden the stroke of the fly."

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36. For *Bearings and Oil Boxes for the journals of Cars, &c.;* John N. Tims, city of Newark, New Jersey, October 31.

The claim is to "the mode of using a sponge or other analogous substance in a box, or compartment, below the journal, for lubricating the same in the manner set forth; said oil box being constructed with a second compartment for containing such oil as may flow over from that in which the sponge is deposited, and for affording a fresh supply to the sponge as it becomes exhausted.—I do not claim the simply supplying the oil below the journal, but only in combination with the said box. I claim the arrangement for supplying the oil and allowing a portion of it to flow off by means of cocks arranged and combined as herein described. I claim the particular manner in which I have constructed the journal and its bearings, in combination with the foregoing lubricating apparatus, consisting in the fillet, or tongue, the recess for checking the lateral motion of the bearing, the respective grooves, and the cap or washer of leather for retaining the oil, in combination, as set forth."

It will be seen that a description, of no mean length, would be required to designate the particular mode of constructing all the parts above referred to.

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37. For *Heel Plates for Boots and Shoes*; W. and W. N. Lewis, city of New York, October 31.

"The nature of our invention consists in the combination of a plate of metal, or composition, with the plate such as is usually worn on boots or shoes, for the purpose of forming a foundation to the outer, or wearing, plate. Also in the method of holding the leather, or other material, which the outside plate is filled in with, by means of undercut edges in the recess on the outer or wearing plate."

A metal plate is to be screwed on to the heel in the usual way, and upon this a second plate is to be screwed by a single screw passing through the centre of each. The outer plate has an undercut depression for receiving a piece of leather, which covers the screw head. This outer plate may be removed when worn out. The claim is to the foregoing arrangement of the two plates.

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38. For *Dies for Stamping Polished Blanks, &c.;* William B. Dunbar, assigned to G. Herrick, Waterbury, New Haven county, Connecticut, October 31.

This die is for stamping buttons, or other articles; and the claim will afford a good general idea of the device which constitutes the subject of the patent.

"*Claim.*—What I claim is the mode of forming the figure in the face of the main dye, by types or movable sections of the figure, so dissected that each can be made and polished separately in all parts, and when united, or set in place, will, in connection with the face of the die, form the figure, and make the impression intended."

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39. For a *Rotary Hand Bellows*; Alexander Ewing, city of New York, October 31.

This hand bellows consists of a rotary fan wheel of the ordinary construction, contained within a circular case, or drum, and made to revolve by means of a winch. All this is sufficiently old, and would not be the subject of a valid claim; that made is to "the arrangement of the circular case containing the gearing, in combination with the fan bellows for increasing the velocity of the same." In this gearing there is but little novelty, and we apprehend that the whole superstructure rests upon an insecure basis.

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40. For a *Printing Press*; Lemuel Kingsley, city of New York, October 31.

"The nature of my invention consists in providing a set of changing motion, or self adjusting and self gearing friskets, and a mode, or modes, of using them, as well as by the arrangement and construction of the friskets themselves with the toothed rack and friction wheel, as the moving them in grooves on projecting or side railways; the changing motions being produced by the frisket rack gearing with, at proper times, the sector wheel and the toothed wheel, at the top of the press. Also the raising of the friskets from the lower to the upper horizontal railway, by the elevators, by the various operations of which the friskets are so moved as to replace one in the last position of the other, alternately."

This press, from the necessary complexity of its parts, is described in a specification of much length, in which numerous references are made to the drawings. It is a "bed and platten power printing press," and in its general construction bears a resemblance to that patented by Otis Tuffts, of Boston.

The claims are to "the method of circulating the friskets over the platten, and back under the same, by making two level railways one above and the other below the platten; with an inclined railway at one end, connecting them; the whole having grooves for the friskets to move in; and in conducting the friskets over the same by means of the pinion and toothed sector acting on the rack attached to said friskets; and also in combination therewith, and as necessary to the circulation of the friskets, the mode of raising the same from one level to the other by means of the elevators, the whole being constructed and operating as described."

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41. For *Ovens for Stoves:* Linus North, Palmyra, Wayne county, New York, October 31.

Claim. "What I claim is the employment of fire breakers located in the flue, under, over, and around, the oven of a stove, by which the flame and hot air are broken and spread, and the heat more equally diffused through all parts of the oven, in the manner described."

42. For a *Combination Furnace:* Augustus Roth, Pottsville, Schuylkill county, Pennsylvania, October 31.

A series of smelting furnaces are built in one stack, and lead into one horizontal flue. Each furnace has two boshes, one above the other, to prevent the too rapid descent of the charge. A steam boiler is to be placed in the horizontal flue, for creating, by the waste heat of the furnace, steam sufficient to work an engine for making the blast. The pipes for heating the blast pass through the horizontal flue.

The claims are, 1st. "The arrangement of fire chambers or boshes, opening into one horizontal flue above, in combination with the boiler for generating steam, and the pipes for heating the blast, placed in said flue; the whole being constructed and operating as described. 2nd. The method of constructing the fire chambers, by contracting them at the centre, and forming two boshes in each chamber, for causing the charge to descend gradually, so as not to obstruct the draught, and prevent the ascent of the lighter substances."

Specifications of American Patents.

Specification of a Patent for a Black Pigment. Granted to Nathaniel Chater, of the city of New York, October 5th, 1839.

Be it known that I, Nathaniel Chater, of the city of New York, have invented a new pigment which I call *patent black*; and I do hereby declare that the following is a full and exact description thereof.

It is intended as a substitute for ivory black, and answers every purpose for which that article can be employed, but is more brilliant in its hue, and infinitely cheaper. It is made from anthracite coal, and may be reduced to powder either in its dry state, in oil, or in water, in any description of mill. The method which I use to prepare the same is to grind it in water in either horizontal or edge stone mills, and to float it off into vats or pits, similar to the grinding of whiting, from which it is taken when it has subsided, and is dried for use. It may then be used for the making of black paint, printers' ink, blacking, or for any other purpose for which either ivory or lamp black is now used.

What I claim as my invention, and desire to secure by letters patent, is the manufacturing of a black pigment from anthracite coal, in the manner herein set forth, or in any other substantially the same.

Nathaniel Chater.

Specification of a Patent for an improvement in Circular Saws. Granted to Jonathan Gove, of Fayetteville, in the county of Cumberland, and State of North Carolina, October 16*th*, 1839.

In the use of the common circular saw a great evil is experienced from the unequal expansion of the metal, arising from unequal friction, and consequent heat, in sawing substances of less thickness or diameter than the semi-diameter of the saw, which causes the saw to buckle, and wabble, and perform its work very imperfectly; the friction and heat being around the periphery of the saw which enters the substance to be cut, whilst there is none around the centre part which does not enter it.

To remedy this evil, I construct the circular saw with springs extending from the periphery towards the centre, a sufficient distance, but not so far as the centre, and between the teeth, whether of the bill hook shape, or of the common form.

I do not claim the making circular saws in segments, as that is not new, but I do claim as my invention, and desire to secure by letters patent, the forming openings in the disk of a circular saw, extending from the periphery towards the centre, in the manner, and for the purpose described.

JONATHAN GOVE.

Specification of the Patent granted to JOHN DANFORTH GREENWOOD, *and* RICHARD WYNN KEENE, *of the county of Surrey, England, for an Improvement in the Manufacture of white Cement, or artificial stone, and in the application of Cement, and other earthy Substances, to the purpose of producing Ornamental Surfaces, October 9th,* 1839.

Our invention relates, first, to a mode of producing cement from gypsum, or sulphate of lime, or other calcareous substances; and,

Secondly, to a mode of producing inlaid patterns of such and other cements, or earthy substances. And in order that our invention may be fully understood, and readily carried into effect, we will describe the means pursued by us, which we have found fully to answer.

To make a White Cement of good quality.

We take any quantity of gypsum, or sulphate of lime, in lumps, as quarried, which is to be deprived of its waters of crystalization by heat, in a similar manner to that employed in the manufacture of plaster-of-Paris of commerce, as is well understood. Into a large tank, according to the quantity of gypsum, place a number of gallons of water, having dissolved therein one pound of alum of commerce for each gallon of water, into which the gypsum above-mentioned is placed, and allowed to remain, until it has taken up as much as possible of the liquid. The stone thus saturated, is then to be removed from the said liquid, and suffered to dry in the air, and is afterwards calcined in an oven, furnace, or kiln, at a low red heat, visible by daylight, in order permanently to fix the alum. The product is next to be ground to a powder, and, if necessary, sifted for use. When a white cement of greater purity is required for particular purposes, we select the cleanest and best quality of gysum, or sulphate of lime, and for a solution, in place of the alum of commerce before-mentioned, we substitute either the clarified or concentrated aluminous mother-liquor (as obtained from the alum works) of the required strength, and which, owing to the absence of alkali and other extraneous matter, more effectually answers the purpose of our invention.

For a Coloured Cement.

We dissolve half a pound of alum of commerce, with one quarter of a pound of copperas or sulphate of iron, in each gallon of water, and at this rate for any number of gallons of liquid that may be required, and excepting the components of this liquid mixture, the process of manufacturing the coloured cement is to be the same as previously described for the white

cement, and the result will be a pale red cement. And further, other gypseous or calcareous substances may be calcined in combination with alum, and with one or more of the sulphates, or other salts of earths or minerals, together or separately, so as to form other cements of different colours and strengths. It should be observed, that in the calcining of the mixtures, heat is not to be continued so as to produce a smell of sulphur, but a workman after a little practice, will soon become fully acquainted with the process. And also, as the gypsum and other calcareous earths vary in their strengths, it is desirable, on commencing, to work with a fresh quantity of any of such substances, to test them by making small samples with different quantities or strengths of alum, or salts of other earths, or metals, in order to ascertain the best proportions for the cement required. In using cements of the above description, first as a stucco for buildings generally, either internally or externally, it is used in the same manner as any other cement or plaster now in use. Should a grit be required, we prefer the scoria or slag of iron, or other vitrified mass, reduced by pounding or other means, to a sharp grit, and use it merely in sufficient quantity to cause the cement to work freely. Where the surface is required to be polished, the last coat is to be of the cement alone, and in most instances the polish given by troweling is sufficient, but a superior surface is obtained by pursuing the methods used in polishing scagliola.

We will now describe the second part of our invention for applying the above cement for producing surfaces with inlaid patterns. We take tempered clay, wax, or other suitable material, which we beat out to the thickness of the intended inlaying, and place it on a smooth surface of slate, glass, marble, or other fit material. We then trace upon it, or transfer to its surface, from paper, the intended pattern, and afterwards cut out the pattern so transferred, slightly beveling or sloping the cut edges. It is now ready for casting in plaster, wax, or sulphur. On the cast thus obtained, having first slightly greased or soaped its surface, the cement, mixed with water to a proper consistence, is closely rubbed on, and in about twenty-four hours is sufficiently hard to come off, having the pattern depressed upon it which is then filled up with cement of any colour required. When dry, the whole is rubbed down to a surface and polished by any of the usual methods. The same method is also applicable to the production of inlaid surfaces in terracotta or pottery of all kinds.

Having thus described the nature of our invention, we would remark, that although we have described the best means of carrying out the same, we do not confine ourselves to the precise methods or quantities explained, provided the principle of our invention be retained; and the cement may be mixed with other materials than those above named, our invention not relating to the mode of mixing and using the cement when made, but consists in the mode of making the cement itself. But we would have it understood that what we claim as the first part of our invention is the mode of making cement from gypsum, or sulphate of lime, or other calcareous earths, by calcining them in combination with alum, or other earthy or metallic salts, as above explained. And

Secondly, we claim the mode herein described of producing ornamental inlaid surfaces.

John Danforth Greenwood,
Richard Wynn Keene.

Specification of a Patent for an improvement in the process of protecting articles of Iron and Steel from oxidation. Granted to PALMER SUMNER *and* PETER NAYLOR, *October 18th*, 1839.

To all whom it may concern: Be it known that we, Palmer Sumner, and Peter Naylor, of the city of New York, have invented an improvement in the "process, method, or methods, by which various articles of iron, or steel, may be preserved from oxidation, or rusting, by the galvanic action produced by zinc," for which process letters patent of the United States were granted to M. Sorel, on the seventh day of December, 1837; and we do hereby declare that the following is a full and exact description of our improvement.

We, the said Palmer Sumner and Peter Naylor, having become proprietors, by assignment, of a right to use the said process, have, in carrying the same into practical operation, found that the malleability of sheet iron is much impaired by giving thereto a coating of zinc, in the manner directed in the specification of the letters patent of the said M. Sorel; and that, in consequence of this diminished malleability, such prepared sheet iron is unsuited, in many cases, to be applied to the purpose of covering the roofs of houses, or to be otherwise used where it is required to be grooved, seamed, or in any way suddenly bent; and our improvement consists in a process by which this difficulty is obviated, whilst the zinc is at the same time so applied as by its galvanic action on the iron, to protect it from oxidation.

We take sheets of iron, and cover them with tin, or with an alloy of tin and lead, adopting in this process the mode, or modes, followed in the well known manufacture of sheets, or plates, of iron into tin plate. After having completed this operation, we submit the sheets, or plates, so prepared, to a like process, with the substitution of zinc for tin, or an alloy of tin; the mode of performing which process is fully set forth in the letters patent granted to said M. Sorel, and does not differ from the ordinary process known under the name of tinning. When thus treated, the plates, or sheets, of iron preserve their malleability unimpaired, and may be bent and otherwise worked as easily as before they had received such coating; a result which appears to be due to the interposition of the coating of tin between the zinc and the iron, by which interposition the chemical combination of the iron and zinc is prevented. Where it is not necessary to use plates of metal of a larger size than that of sheets of tin plate, we take that material as it comes from the manufactories, and have then only to give to it a coating of zinc, to receive which it does not require any particular preparation.

In the letters patent granted to M. Sorel, it is proposed, sometimes, to add a coating of tin *over* that of the zinc, for the purpose of giving to the article made, a brighter appearance, and as an improvement also in culinary vessels; but our process is the reverse of this, and the end attained by us altogether different from that above proposed, and, at the same time, our process produces a new and useful result.

What we claim, therefore, as our invention, and as an improvement on the process of M. Sorel, is the preserving the malleability of sheet iron, whilst it is protected from oxidation by the galvanic action between it and the zinc, in the manner above set forth, namely, by first tinning said iron in the ordinary way, and afterwards by giving thereto a coating of zinc above the tin.

PALMER SUMNER,
PETER NAYLOR.

Specifications of English Patents.

Specification of a Patent granted to William Bates, *of Leicester, fuller and dresser, for his invention of improvements in the process of finishing Hosiery and other looped fabrics.*—[Sealed 4th June, 1839.]

The patentee states:—My invention relates to certain modes of finishing hosiery and other looped fabrics, known by the names of lamb's wool, worsted, Angola, and cotton, by the means herein mentioned and explained.

According to the ordinary process pursued previous to my former patent, Angola and cotton goods were finished by being submitted to a process of ironing by hand; lamb's wool goods were not usually either ironed or pressed, but if occasionally they were pressed, it was without having legs or shapes inserted in them; worsted goods were usually pressed, but not upon legs or shapes; and rough or undressed goods were generally merely put upon legs, and exposed to heat by means of a stove, to give them size and shape. And in my former patent I did describe a certain mode of finishing goods made of elastic stocking fabric, and known by the name of lamb's wool, worsted, and Angola, by placing within them legs or other shapes, according to the nature of the articles to be operated on, and in that state submitting the fabric to the hot pressure of any suitable surfaces, produced by the heat of fluids; and I have since discovered that pressure, under such circumstances, that is, having shapes or forms inserted into the articles to be pressed, is beneficial, even though the surfaces are not heated; and one part of my present invention relates to the pressing such Angola, cotton, worsted, and lamb's wool knit or looped fabrics, with suitable shapes or forms within them, and whether rough or dressed, by the aid of flat or other pressing surfaces, worked by screw or other presses; and in performing this part of my invention, supposing the articles to be finished, according to this part of my invention, to be stockings, each stocking has a thin flat leg, or shape of wood, or other suitable material, inserted into such stocking; in this state they are to be submitted to pressure, in a similar manner to that described in my former patent; but the operation takes longer time, that is, from ten to fifteen minutes, or more; and in case rollers be used as the press, then it is desirable to pass the articles through several times, or by a very slow movement.

At the same time I would remark, that I do not consider rollers so good a description of press as the various kinds of presses having flat surfaces. I have mentioned stockings as the articles to be treated or finished. I would however, remark, that the same description applies to other articles; and the only difference is the flat shapes or forms of wood, or other suitable material, put into the article to be treated or finished, according to this part of my invention; by this mode of working, I dispense with the application of heat.

Another part of my invention relates to the application of heated shapes, legs, or forms, in the finishing of stockings or other knit or looped goods of lamb's wool, worsted, Angola, or cotton, and subjecting such stockings, or other knit or looped goods of lamb's wool, worsted, Angola, or cotton, to pressure whilst they are inserted on such heated shapes, legs, or forms; and the same is performed by heating the flat legs, or other forms or shapes, before inserting them into the stockings or other articles to be finished by this process, and such heating may be performed in any suitable manner.

I have found, that any degree of heat which will not burn or cockle the

articles under operation, quickens and improves the process of pressure when using legs, forms, or shapes, within the articles operated on; and the best means I am acquainted with for heating the legs, shapes, or forms, consists of an oven or such like vessel, heated by means of steam of fifteen to twenty pounds on the square inch, though other apparatus or means may be resorted to.

My invention not relating to the modes of heating the legs, forms, or shapes, inserted into the knit or looped articles of lamb's wool, worsted, Angola, or cotton, but to the application of such heated shapes, legs, or forms, in the finishing of such descriptions of goods; and having inserted such heated legs, forms, or shapes, into the goods to be pressed, I place them between two surfaces of a press; and I prefer placing them in single layers, using, by preference, the flat surfaced presses; and where more than one layer is placed in a press at one time, it is desirable to place, between each layer, a smooth sheet of millboard, or other suitable material, in order to keep the layers separate; and in case no such millboard or other material be placed between the layers, then it is desirable to have the goods placed on the legs, forms, or shapes, with the outside towards the legs, forms, or shapes, particularly where great pressure is required; and by this means, and submitting the goods to pressure, as above described, for from three to ten minutes, according to the extent of finish desired, a very beneficial operation of finishing will be obtained.

Another part of my invention relates to other means of applying heat in the process of finishing knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when the articles are placed on legs, forms, or shapes; and consists of employing heated surfaces produced by the heat of fire or flame, or by heating surfaces with fluids, without such fluid being in contact therewith, or contained therein; and in place of employing heated surfaces containing hot fluids, as was the case in my former patent; and in order to give the best information in my power as to this part of my invention, I will proceed to describe the means pursued by me, and which I believe will be found, in practice, the best for performing this part of my invention. And I would first remark, that the legs, shapes, or forms, inserted into the goods, may be heated or not when performing this part of my invention; and I perfer, that in place of heating the surfaces of the press itself, to employ flat plates of copper or iron, or other suitable material; and in case of iron, I put sheets of millboard between the goods and iron plates, which, being heated, are to have a layer of the goods, with legs, shapes, or forms, inserted therein, as above explained. And I prefer having the goods in single layers, placed between two such plates, and then the plates and the goods between them placed in any suitable press, preferring those with flat surfaces, and thus submitted to pressure from three to five minutes; and it should be stated that, in heating such plates, care is to be observed not to heat them to such an extent as would burn or cockle, or otherwise injure the fabrics; and I usually employ iron ovens, heated by the direct action of fire, or the same may be heated with steam or other fluid. In case it be preferred to heat the surfaces of the press itself, this may be done by having suitable openings in such surfaces, to receive burning charcoal or hot irons, or gas, which, being previously heated, are to be placed in the hollow surfaces of the press; and in case rollers be used as the pressing means, then the same should be formed with suitable hollow axes to receive heated iron or gas, thereby to heat the pressing surfaces of the rollers; but, I would remark, in respect to this part of my invention, that I prefer to use plates separately heated by any convenient means, and to place between each two of them

a layer of the articles, having legs, shapes, or forms inserted therein, and submitting them, in that state, to the action of any suitable press or pressure; and I prefer placing millboard between the articles and the plates.

The object of the present invention being the employment of suitable heated surfaces, heated by any other means than hollow surfaces, heated by steam, hot water, or other fluids, when such employment of heated surfaces is combined with the employment of legs, shapes, or forms inserted in the articles undergoing the finishing process. It should be remarked, that in treating or finishing knit or looped Angola goods by hot pressure, it is desirable that they should be placed on legs, shapes, or forms, in a damp state.

Another part of my invention relates to submitting knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when on legs, shapes, or forms, to the action of steam, whereby the character and appearance of such goods will be improved; and in order to perform this part of my invention, having placed a number of stockings on legs, or drawers, shirts, waistcoats, or other articles, on proper shapes or forms, I place them in a suitable chamber, which will contain steam; and I either suspend them in such chamber, or have a series of open shelves, on which the articles are laid; and I prefer placing them in single layers, and in this state allow them to remain, in what may be called a steam bath, for about three minutes, and then immediately press them whilst they are hot and damp from the action of the steam, or I permit them to dry on the legs, shapes, or forms, and in some cases without pressing them at all. The steam I use is five pounds pressure on the square inch; the chamber or bath being provided with an outlet to run off the condensed steam. The steam chamber I prefer to be quadrangular, sufficiently strong to resist the pressure employed; and having a door or opening readily removed, in order readily to place in and remove the goods, and yet sufficiently steam tight to waste but little steam.

Having thus described the nature of my invention, I would have it understood that what I claim is, first, the mode of finishing knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when on shapes or forms, by means of pressure, without heat, as herein described; secondly, I claim the mode of finishing knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, by means of pressure, when on heated shapes, as above described; thirdly, I claim the mode of applying heated surfaces, in combination with the employment of legs, shapes, or forms, when such heat is obtained to the surfaces by any other means than by steam, hot water, or other fluids circulating in the hot pressing surfaces, as above described; and fourthly, I claim the mode of treating knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when on legs, shapes, or forms, by means of a steam bath, and either with or without pressure, as above described. Lond. Jour. Arts & Sci.

Specification of a Patent granted to James Drew, *of Manchester, in the county of Lancaster, Civil Engineer, for improvements in the means of Consuming Smoke and Economising Fuel in Steam Engine and other Furnaces, or Fire-places.*—[Sealed 8th November, 1838.]

These improvements in the means of consuming smoke and economising fuel in steam engines or other furnace, or fire-places, consists in providing the furnace or fire-place with a second or double set of fire bars, the one set or outermost of which are to be fixed to the boiler seating as in ordinary

furnaces, and the second or innermost set are to be fixed upon a carriage which shall be movable in a vertical direction, immediately behind the outer set of bars; and thus the improved furnace will be divided into two distinct parts or portions; the first or ordinary half, or any convenient part thereof, will support the fuel in the furnace, and the second or movable set be capable of being raised nearer to or further from the bottom of the boiler, as occasion may require.

The object of my invention being the more perfect consumption of smoke, and the consequent economy in fuel, is effected by such novel arrangement and construction of the furnace or fire-place, as the first or outermost set of fire-bars is intended to receive the fuel when it is firstly introduced into the furnace, and the charred or red hot coal is to be passed backwards, and thus placed upon the second or movable set of fire-bars, and immediately raised by the sliding carriage close under the bottom of the boiler, and placed nearer to or farther from the boiler, as the case may require, thus forming a narrow heated passage, causing the smoke to come in contact with the charred or red hot coal, the heat from which passes under the bottom of the boiler on its way to the flues, and as it rises from the green or fresh coal in the front part of the furnace, it will be perfectly consumed in passing over the second or red hot fire instead of being allowed to escape along with other gaseous products to the chimney, and thereby cause a considerable saving of fuel and heat, which is commonly lost. As the principal feature of novelty is so perfectly simple that it may be readily applied to any description of furnace or fire-place, I had scarcely deemed it necessary to represent its application to any one in particular, as it is evident that its adaptation to the various descriptions of furnaces must greatly depend upon the circumstances of the case; and also the mechanical arrangements, and other details, for raising or lowering the second or inner set of fire-bars, must entirely be at the option of the engineer.

It will readily be perceived that the mechanical agents or apparatus to be employed to carry my invention into practical effect, are capable of a variety of modifications, and however applied, will not in the least affect the result of the operation.

[A figure is given in the specification which we do not deem necessary to the understanding of the invention. The second set of fire-bars is placed so as to be easily brought, by screw or lever machinery, to a level with, or depressed below, or raised above, the common grate bars, so that the ignited and incandescent coals can be brought near the bottom of the boiler, and the throat or flue being thus constructed, the smoke and cinders of the fresh fuel have to pass over, and in contact with, the ignited coals.]

Having thus described the object of my improvements, and the manner in which the same may be carried into practical effect, I desire it to be understood, in conclusion, that I claim as my invention the elevation of the second set of fire-bars or back part of the furnace, either in a level or inclined position, and the lowering of the same in the manner and for the purposes above described, in whatever situation it may be used in connexion with ordinary furnaces or fire-places; and also by whatever ordinary mechanism or apparatus the same may be worked, as the lever, screw, rack, or any other well known agent may be effectively employed. Ibid.

Specification of a Patent granted to Joseph Gibbs, *of Kensington, Engineer, for an improvement or improvements in the Machinery for Preparing Fibrous Substances for Spinning, and in the mode of Spinning certain Fibrous Substances.*—[Sealed 21st December, 1839.]

This invention is described under three distinct heads; first, an arrangement of machinery for breaking the woody parts, or boom, from raw flax, New Zealand flax, and hemp, and partially separating the fibres. The material is fed into the machine through horizontal spouts or troughs, whence it passes between rollers, weighted, to produce pressure. These rollers have teeth or angular indentations all over their peripheries, in order that, as they revolve, they may pinch the material and crack the boom; and besides their rotary motions, the rollers have also lateral movements upon each other, which assist in breaking the boom, and thereby preparing the material for the subsequent operations of heckling and spinning.

The construction of the machine may be easily conceived. The rollers are all made to revolve by toothed gear upon their axles, driven by one actuating wheel and pinion, and the lateral movements are produced by excentrics upon the axle of the driving wheel, which cause the rollers severally to slide endways.

The feature of novelty claimed, is merely the particular arrangement of the parts shewn in the several figures of the drawing appended to the specification, constituting, as a whole, a machine for breaking and preparing flax, &c.

The second head of the invention, is the employment of a sort of scribbling engine for preparing floss silk. The silk is conducted, in an uniform thickness, from a feeding table, between rollers, to the cylinder or barrel, covered with fine pins, which, as it revolves, takes up the fine filaments of silk, and they are pressed in between the pins on to the surface of the barrel, as it goes round, by a cylindrical brush, which lies in contact with the barrel. When a sufficient quantity of the silk has been thus lapped on to the surface of the barrel, the operation is suspended, and the lap of silk so formed is then taken off in a sheet and placed in another machine, to be drawn and spun into threads or yarns; or the lap of silk may be separated in its width into several sliders, and passed immediately between drawing rollers to the spinning machine. In this part of the invention, the arrangement only of the whole machine is claimed as new, not the parts separately considered.

The third head of the invention, is the production of a peculiar sort of yarn, which is made by spinning or winding very fine fibres of cotton or other material, round a previously spun yarn of flax, or other fibrous thread. To effect this, any convenient construction of spinning or winding machinery may be employed, in which the previously spun yarn may be conducted from a bobbin, and brought under the operation of a winding flyer. The object of this winding is to give tenacity and strength to fibres of extremely delicate and fine materials. Ibid.

Specification of a Patent granted to John Swindells, *of Manchester, in the county of Lancaster, Manufacturing Chemist, for his invention of certain improvements in the Manufacture of Prussian Blue, Prussiate of Potash, and Prussiate of Soda.*—[Sealed 16th April, 1839.]

This invention of an improved method of manufacturing prussiate of potash, prussiate of Soda, and Prussian blue, consists in producing the same

during the process of manufacturing carbonate of potash, carbonate of soda, and British alkali, commonly called soda ash.

The common method pursued in manufacturing these articles, is by forming a mixture of the sulphate of potash, or sulphate of soda, lime, or carbonate of lime, and small coal or any other carbonaceous matter, and subjecting them to heat in a reverberatory furnace, and thereby decomposing the sulphates, and producing carbonate of potash or soda; and likewise a quantity of sulphuret of potassium or sodium, according to the article operated upon.

The patentee states, that "in my process I dispense with lime or carbonate of lime, and use, along with the various sulphates, a quantity of ground coal of the best caking description; and also a quantity of iron filings or borings, in manner following, namely:—I take any quantity of the sulphate of potash or sulphate of soda, and fuse them in a reverberatory furnace, such as is commonly used in the manufacture of alkalies; and then I add, by degrees, a mixture of small caking coal and iron filings, (in the proportion of one part of iron filings to eight of coal,) until I have added to the fused sulphate one half of their weight of coal, or more, if the sulphates require it, taking care to stir the materials well during the addition of the coal and iron filings, and also for ten or fifteen minutes after the whole of the coal is added, when the material will be ready to remove from the furnace, and allowed to cool.

I also produce the same results by mixing, in the first instance, the coal and iron filings with the various sulphates, and then fusing them in the furnace in the usual way; or the iron filings may be omitted in the process, but I prefer the addition thereof. The materials, after being cooled, I take and dissolve in water, and when the solution has subsided, I evaporate the same until it has obtained a specific gravity of 1.320, at a boiling heat; then I transfer it into coolers, when the prussiate of potash or prussiate of soda crystalizes in the course of four or five days; the solution now will consist of carbonate of potash or soda, and sulphuret of potassium or sodium, which sulphuret may be removed by the usual methods employed for that purpose.

The crystals of prussiate of potash, or prussiate of soda, will be required to be re-dissolved and re-crystalized, when they will be ready for use or sale; or they may be manufactured into Prussian blue, in the usual way.

Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

Anthracite Iron.

A series of experiments has been lately made of the quality of anthracite iron manufactured by the Ystal-y-fera Company, in the Swansea Valley. We are indebted to the gentleman (Mr. Richard Evans, of Manchester) under whose superintendence the tests were submitted, for a very detailed report of the results, which, we regret, from its length, we are unable to transfer to our columns. It will be our object, however, to render an abstract of the paper before us, which is in itself of too scientific and technical a character to be understood by our general readers. Mr. Evans having been requested to examine and report upon the strength of the several qualities—Nos. 1, 2, and 3—of the Ystal-y-fera iron, with a view to ascertain its properties, particularly in relation to other descriptions of iron,

proceeds in his report to give the results of about 280 experiments upon rectangular transverse bars, taking as the most satisfactory and methodical arrangement, that adopted by Messrs. Fairbairn and Hodgkinson, in the series of experiments reported in the "Sixth Report of the British Association." In effecting this, care was taken to follow closely the practical parts of the investigation of those gentlemen, by breaking the bars between supports of their distances—viz., of 4 ft. 6 in. and 2 ft. 3 in. apart. The trials were confined to the transverse strength of 1 in. rectangular bars, with their several values, as follow:—1, specific gravity; 2, modulus of elasticity; 3, transverse strength of 1 in. rectangular bars, 4 ft. 6 in. apart; 4, transverse strength of 1 in. ditto, 2 ft. 3 in. apart; 5, ultimate deflection; 6, power to resist impact, into which the tables are divided. The bars broken being from seventy-two specimens of No. 1—sixty-five of No. 2—and sixty-one specimens of No. 3—cast horizontally in sand, and melted by coke from the cupola in the ordinary way. In addition thereto were forty-four bars, being equal mixtures of Nos. 1, 2, and 3; twenty-four bars of the same quality, but planed down to a perfect 1 in. square gauge; and sixteen bars of the same mixture, but melted in the crucible. The several trials were effected with the greatest care, for which Mr. Evans expresses his obligations to Messrs. Whitworth and Co. (by whom the castings were furnished), and for the general interest and care manifested by those gentlemen to arrive at satisfactory results. It is unnecessary to enter into those details, suffice it to say, that they exhibit a proper regard on the part of Mr. Evans and others to give a correct result, and by the practical man will be duly appreciated. The first series of experiments made was on No. 1 Ystal-y-fera anthracite iron, with the view of ascertaining the transverse strength and elasticity of rectangular inch bars, to effect which seventy-two experiments were made at 4 ft. 6 in. and 2 ft. 3 in. distance between supports, as already mentioned.

We must necessarily confine our extracts from the report to the summary or abstract of the several experiments made, of which the following will be found to give the result—the numbers of the experiments referred to being explained in note at foot:—

Summary and comparison of the total mean results of the various tables, together with the same from Messrs. Fairbairn & Hodgkinson's list:—

	No. of experiments.	Specific gravity.	Elasticity in lbs. per square inch.	Breaking cwt., lbs. in bars 4ft. 6in.	Breaking cwt., lbs. in bars 2ft. 3in.	Ultimate deflectn. in parts of in.	Power to resist impact.
1*	72	7.093	13970644	444	445	1.843	821
2	65	7.120	14544293	494	499	1.632	811
3	61	7.130	16622197	531	537	1.640	916
4	41	7.110	15200982	465	479	1.553	749.7
5	16	7.190	14894800	551	597	1.625	901.2
6	24	7.110	14676771	533	539	2.447	1313.1

* In the tables, the figures used for reference are thus explained:—1. Mean of experiments on No. 1 Ystal-y-fera anthracite iron. 2. Ditto No. 2 iron. 3. Ditto on No. 3 iron. 4. Equal mixtures of Nos. 1, 2, and 3. 5. The same mixtures, but from the crucible. 6. Equal mixtures of Nos. 1, 2, and 3 iron, but planed bars. 7, 8, and 9, referring to the tables of Messrs. Fairbairn and Hodgkinson, being respectively, No. 1, No. 2, and No. 3 iron.

Forty-seven specimens from Messrs. Fairbairn and Hodgkinson's Tables of Nos. 1, 2, *and* 3, *as under:—*

7	10	7.032	14132994	433	428	1.597	694
8	25	7.029	14570118	435	443	1.626	711
9	12	7.122	17683712	478	487	1.374	685

Summary of the mean of the 198 *results of the three quantities of Anthracite, and the forty-seven from Messrs. Fairbairn and Hodgkinson's list:—*

198	7.114	15045711	489	493	1.705	849
47	7.060	15462274	418	452	1.532	696

In making a comparison of the same numbers of the anthracite iron, and those which are comprised in the latter forty-seven results, the first three of the six only, contained in the preceding table, must be taken, the other specimens being on iron, under other conditions, containing the mixed, planed, and crucible results, &c.

The last summary, if taken singly, or collectively, shows a superior value in every column in favour of anthracite iron as compared with the most numerous list of other makes; and it would appear that the No. 1 is the most uniform in texture, strength, &c., having the greatest fluidity, softest, and lowest specific gravity, and for its strength, which is the weakest, is most to be relied upon, as far as it extends.

The No. 2, less uniform, a little, in texture, and strength, fluidity, &c., but of higher specific gravity, and stronger than No. 1.

The No. 3 still less to be depended upon in the above qualities, but of increased specific gravity and strength to the No. 2.

The equal mixtures show a deterioration of the several Nos., compared to their values separately, and the same as regards specific gravity. The same, but cast from a crucible, exhibit an improved list of values, including a greater specific gravity.

The planed bars show an increased strength above the same metal in the black bar; this is the only specimen whose strength is increased, without the specific gravity being greater also, which must be due to the planing, and not to any alteration of metal, &c.

It may be inferred from the whole of the tables, except the last, that the higher specific gravity exhibited by the iron, the greater the strength.

The following observations are appended to the table of experiments with No. 1 iron, of which we have given the results in the preceding tables:—

The specific gravity of No. 1 iron at 7.093, is rather under the standard 7.207, as given by Tredgold, but above the mean of the No. 1 in Messrs. Fairbairn and Hodgkinson's list, which give 7.032 for twelve different irons of this number. As Tredgold's is a general one, and not the result of any particular number, and as it will be found in anthracite iron, as well as in Messrs. F. and H.'s results, that the No. 1 is usually a lighter iron than either of the Nos., the above may be considered a near approximation to the usual irons of the same No. or quality made from coke.

Its modulus of elasticity, the mean of which is 13970644, shows the comparative stiffness of the metal, and is given in pounds per square inch.

The breaking weights are given in three separate tables, the mean of which makes 444 lbs., 445 lbs., and 444.5 lbs. respectively, which approximate in rather a singular manner to each other, and must be taken as the

best proof of the uniformity of strength and texture of this number, the of which, as compared with other irons, stand as under:—

Mean of 72 results, upon the Ystal-y-fera anthracite iron, No. 1 44
Ditto of 10 different sorts of No. 1, in Messrs. Fairbairn & Hodgkinson's list, ... 4

being a superior strength in favour of the anthracite iron of about cent. I regret that most of the other authorities give the breaking o bars on a very limited scale, in few instances distinguishing the dif Nos. they were made from, and broken between distances of every va which is an additional objection to my offering them in the above com son; but in a summary of a few that I found most easy to reduce, they rather an inferior value to Messrs. Fairbairn and Hodgkinson's irons.

This number, in internal structure, appears to bear out the unifo just noticed, by its regular, dark gray appearance at the fracture, wi appearance of soundness and great smoothness in the pig and castings; broken, the pig does not ring, but sounds rather like lead; it is also s as to yield readily to the chisel. In addition to the uniformity of str just noticed, and that it is particularly sound, and free from air holes fects in casting, may be inferred from the fact, that it did not produce waster from any defect at the fracture, in the seventy-two trials; and is from excess of carbon that iron acquires the several qualities of unifor fluidity, smoothness in the castings, &c., this metal must be highly ch with it. In ultimate deflection and power of resisting impact, it also tains its superiority at 1.843 and 821, the mean of the ten before-ment irons giving 1.597 and 694.

From the improvement the above iron appears to impart, by mixing inferior irons, of which I have on record, from my engineering fri several practical examples, I have no hesitation in saying it will com tensively into use for this application alone.

We regret we have not space for the observations which accom each series of experiments, but the preceding remarks will give some of the views entertained by Mr. Evans, and the mode adopted by that tleman.

Such is the substance of the report before us, and which we are gl have the opportunity of submitting to our readers who are interested i subject of the properties and application of anthracite. Mining J

Smith's Patent Wire Rope.

Having already noticed this material, and adverted to the eco arising from its application, as regards its weight, size, and durabilit are glad to have it in our power to report the result of a series of ex ments, which took place by order of the Lords of the Admiralty, at Majesty's Dock-yard, Woolwich, on the 20th inst., under the imme inspection of W. Tinmouth, Esq., at which we were present.

Considerable interest had been excited with reference to the tes several specimens of hempen rope having been carefully selected, or r prepared, for the experiment, so that a trial was made, not only of wi hemp, the results of which are very interesting, and would have been more so had the series of experiments been perfect. However, the re so far as were arrived at, were of a satisfactory nature, as will be see the subjoined report, which we compared with the Government autho

The following are the results of a trial made with hempen rope:—

Size of rope. Inch.	Length of rope. Ft. in.		Weight per fathom. Lb. oz.		Broke at a strain of Ton cwt.		Stretched before breaking. Inch.
3	9	7	2	1	2	10	18
$4\frac{1}{2}$	7	6	4	2	4	0	15
6	6	4	7	3	8	5	10
8	5	2	13	$12\frac{1}{2}$	20	15	$7\frac{3}{4}$
10	6	3	21	6	32	10	$6\frac{1}{2}$
12	6	1	29	6	—	—	—

The following are the results of the patent wire rope:—

1	13	4	1	0	3	0	$1\frac{1}{2}$
$1\frac{5}{8}$	13	2	2	$7\frac{1}{2}$	5	10	$1\frac{1}{8}$
$1\frac{7}{8}$	13	5	3	1	6	15	$1\frac{1}{2}$
$2\frac{3}{4}$	13	6	7	4	14	0	1
$3\frac{5}{8}$	13	9	9	11	17	5	1
$4\frac{3}{8}$	13	6	18	9	—	—	—

From the preceding statement, it will be seen that, in the two first of the series of experiments, the comparative weight and strength of the materials were—

3 inch hemp rope, weighing 2 lbs. 1 oz., broke at a strain of 2 tons 10 cwt.
1 inch wire rope, weighing 1 0 ditto 3 0

It will thus be seen, that the wire rope of one-third the circumference, and with one-half the weight of the hempen rope, was capable of bearing an additional strain of 20 per cent.

In the second experiment—

$4\frac{1}{2}$ inch hemp rope, weighing 4 lbs. 2 oz., broke at a strain of 4 tons 0 cwt.
$1\frac{5}{8}$ inch wire rope, weighing 2 $7\frac{1}{2}$ ditto 5 10

Here, again, we find that a wire rope of about one-third the circumference, sustained a strain of nearly 40 per cent. beyond that of the hempen rope. And here we may remark, with respect to these tests, on the difference observable in the two materials as to the "stretching" before they broke, in the instance of the 3-inch hemp which broke at a strain of 2 tons 10 cwt., we find that it stretched or extended 18 inches on a 9ft. 7 in. length, while with wire rope of 1 inch, which broke at 3 tons, the stretch on a length of 13 ft. 4 in. was only $1\frac{1}{2}$ inch, or about one-eighteenth part of that of hemp.

With reference to the other tests, we consider it would be unfair on both sides to draw any deductions. As regards the hemp rope, the "seizings" were in several instances obliged to be restored, and the trial could hardly be said to be fair, while in the case of the 12 inch rope, it was withdrawn, to be subjected to another trial, the "seizing" having slipped before the strength could be ascertained. A similar defect on the part of the patentee was also observable as respects the splicing of the wire rope, the "splice" having given way in the last four experiments, although, we believe, that the main defect was in the "thimble" around which the rope passed not being sufficiently large, or of a concave form, to take the wires, and which not being "served," spread over the sides of the "thimble," and consequently, allowing the strain to be imperfectly applied. This was so manifest to all present that the authorities under whom the experiments were made, at once expressed their willingness to submit the rope to a further

test, which will, we understand be made next week. Under such circumstances, we do not feel it right to make any remarks. As a proof of the strength of the wire rope, we may observe, that in trying the strength of a $4\frac{3}{8}$ inch rope, one of the "shackles" employed, made of best $1\frac{1}{2}$ in. iron, or $4\frac{1}{2}$ inch diameter, snapped, when the strain was $23\frac{1}{4}$ tons—we are happy to say without any injury. This rendered the experiment nugatory, as will be observed above.

We feel it a duty to acknowledge the kindness and urbanity of Mr. Tinmouth, and the fairness and liberality evinced on the part of the authorities, and on that of the patentee, throughout the trial; it was pleasing to see a desire evinced on both sides to arrive at correct results, without the slightest prejudice being allowed to manifest itself.

Captain Routh (the managing director of the London and Blackwall Railway,) Mr. Maudsley (the engineer), Mr. Newton (the patent agent), Mr. Turnbull (Her Majesty's consul for Havanna), and several naval officers, with the Government authorities, and other gentlemen connected with science, were present during the trial, which lasted for upwards of four hours.

Ibid.

Mr. Spencer *on Further Improvements in the Voltaic Process of Multiplying Works of Art in Metal.*

To the Editor of the Athenæum.

Sir—I take this opportunity of laying before yourself and readers a brief detail of a still further improvement of my voltaic process of multiplying works of art in metal. In my pamphlet, printed last September (*Athen.* No. 626,) I there stated that I considered the process comparatively incomplete, unless we were able to apply it to the multiplication of models in clay or wood, castings in plaster, wood engravings, &c., as the fact, that galvanic deposition always requires a metallic surface to act on, seemed to set bounds to these branches of its application. I then resorted to various expedients to surmount the difficulty,—among others, that of gilding and bronzing the surfaces of such materials to a limited extent; this was successful, but still troublesome and expensive, and, more than all, the sharpness and beauty of the original was necessarily injured. I have since attempted to metallize surfaces by the use of plumbago, (suggested to me many months ago by Mr. Parry, of Manchester.) This last possesses some of the faults common to the others in a greater degree, and in some instances the deposition goes on partially.

I am happy, however, to inform you, I have now adopted a method which answers completely, obviating all these objections, and leaving the surface of the material to be acted on as sharp as it was previous to the operation.

Should I be desirous of obtaining a copper mould or cast from a piece of wood, plaster, or clay, or, indeed, any non-metallic material, I proceed as follows:—Suppose it is an engraved wooden block, and I am desirous of metallizing it, in order that I may be able to deposit copper on its surface, (this example will hold good for any other material,) the first operation is to take strong alcohol, in a corked glass vessel, and add to it a piece of phosphorus (a common phial corked will answer the purpose); the vessel must now be placed in hot water for a few minutes, and occasionally shaken. By this means the alcohol will take up about a 300th of its bulk of phospho-

rus, and we thus obtain what I would term an alcoholic solution of phosphorus. The next operation is to procure a *weak* solution of nitrate of silver, place it in a flat dish or saucer; the engraved face of the block must now be dipped in this solution, and let remain for a few seconds, to allow capillary action to draw it into the wood.

This operation being performed, a small portion of the alcoholic solution of phosphorus must now be poured in a capsule, or watch-glass, and this placed on a sand-bath, that it may be suffered to evaporate. The block must now be held with its surface over the vapour, and *an immediate* change takes place; the nitrate of silver becomes deoxidized, and gives place to a *metallic* phosphoret of silver, which allows the voltaic deposit to go on with as much rapidity and certainty as the purest silver or copper.

The whole process may be performed in a few minutes, and with absolute certainty of success. The interior or the exterior surface of a plaster or clay mould of a statue, no matter what size, may be thus metallized with equal facility. For the process of vaporizing, and should the material to be acted on not be very large, I prefer fastening it to the top of a bell glass receiver with a bit of pitch or cement, and thus placing it *over* the capsule on the sand-bath; the phosphoric vapour is by this means equally diffused, and not dissipated. An ethereal solution of phosphorus also answers; and a solution of either of the chlorides of gold or platinum may be used. I am inclined to think this process, independent of its uses in galvanic precipitation, may be applicable to other branches of art. I would recommend those curious of testing its effects, to try a small and sharp plaster of Paris medallion: dip its *surface* in a weak solution of nitrate of silver and *take it out immediately*, fasten it to the bottom of a glass tumbler, and at the same time have a little hot sand ready in a dish; lay the watch glass, containing a few drops of the phosphoric solution, on it; now place the mouth of the tumbler over all, and the medallion will be observed almost instantly to change colour. The operation is now completed. A piece of pottery ware in the state of biscuit may be acted on in a similar manner.

Liverpool, June 27. THOMAS SPENCER.

Athenæum.

HALL'S *Hydraulic Belt.*

This invention is simple, consisting, as it does, of an endless woollen belt, passing over two rollers—the one being fixed at the top of the shaft, and the other at a slight depth below the surface of the water, in the sump. By giving motion to the upper roller, whereby the belt acquires a velocity of 800 to 1000 feet per minute, the gravity of the water is overcome, and raised to the required elevation in a uniform and continuous discharge from the physical properties inherent on the principles of capillary attraction and centrifugal force.

We are given to understand that the cost of the belt, with all the machinery necessary to work it, will not exceed one-third of the expense incurred in the erection of the common pump, while the power acquired is said to be greater—at the same time, that it is not subject to the casualties incidental to the ordinary pump.

The rapid motion of the belt occasions it to act as a powerful ventilator, and therefore possesses a further claim to attention in connexion with some of its applications, to which we may hereafter direct attention.

Having seen the belt in operation at the Polytechnic Institution, where

a four inch band is employed in raising water twenty feet high, with a copious discharge, we availed ourselves of the opportunity afforded us, by an invitation from Mr. Hall, the patentee, to inspect the belt in action, on a more extended scale, at Portman Market, where, accompanied by a scientific friend, we made our observations, and which we now present to our readers.

The mean depth of the shaft, or pit, from which the water is raised, is 134 feet, and the power employed is that of a steam engine, of eight inch cylinder, with a seventeen inch stroke, working at twenty-two pounds on the inch; this being attached to the upper roller, as already described, works a band of four and three-quarters inches width, traveling, as we were informed, at the rate of 1000 feet a minute, but which we did not prove, our attention being more immediately directed to the quantity of water raised in a given time. That our readers may follow us, we will at once proceed to describe the apparatus employed, and the measures we adopted to arrive at the result, which, however, in the course of the ensuing week, we purpose again testing; the conclusions at which we arrive not being in accordance with those previously obtained by other parties, possibly arising from circumstances which may be explained, and the trial in our case being made in the absence of the patentee.

As we have already observed, the motive power is attached to the upper roller, or drum, over which the belt runs, communicating with the lower roller, which is placed in the sump, or water pit, and thus forming an endless band. The rollers being in action, the belt travels, carrying with it a face or band of water, which, having reached the summit, discharges itself into a vat of the dimensions of six feet by seven feet ten inches—each inch in depth, with such superfice, being estimated as containing $24\frac{1}{2}$ gallons, the weight being determined by Mr. Donkin, by experiment, as $245\frac{6}{10}$lbs. During the experiment made, of four minutes, the quantity of water discharged into the vat was equal to $4\frac{11}{16}$ inches—the last minute giving $1\frac{3}{16}$ inch, the engine working fifty-six strokes per minute. Mining Jour.

Wire Rope for Mining Purposes.

Some years have elapsed since the introduction of the wire rope, to which, we believe, we first directed attention in this country. M. Albert, of Clausthal, having communicated to Dr. Karsten the result of experiments made, in 1834, by him in the mining district of the Upper Harz; the importance of which may be gathered from the fact, that the estimated quantity of new rope required annually is 38,500 feet. A patent, it appears, has been taken out in this country for the manufacture of wire rope, by Mr. Smith, of Poplar, and having had an opportunity of seeing the various descriptions of rope manufactured under the patent, we are induced to direct the attention of our readers to an invention which promises to be most useful, and, in many respects, invaluable.

The patent consists of improved methods of preventing oxidation, and combining wires in a manner so as to render them more flexible than any hemp rope of the same strength; and experiments having been made in her Majesty's Dock-yard at Woolwich, by order of the Lord Commissioners of the Admiralty, it is proved that a two inch patent wire rope bore half a ton more strain than a seven inch hemp rope. With the object of introducing the wire rope for mining purposes, we may take, for instance, a hemp rope,

100 fathoms long, which we will assume as weighing 20 to 25 cwt., while a patent wire rope, of equal strength, is only one-third that weight, thereby making a considerable difference in the application of the two ropes, with reference to the power required; at the same time, it is estimated a saving in cost of 30 per cent. is effected.

If we take a six inch rope (hemp,) we find it will bear a strain of eight tons, its weight being about nine pounds per fathom. To obtain a wire rope capable of an equal tension or strain, it appears that one of two inch is adequate, the weight of which is only two pounds two ounces.

The importance and value to be attached to the wire rope is thus rendered manifest, as in our deep mines, of 250 to 300 fathoms, where we will, for argument sake, assume that a nine inch rope is used, we shall find that the dry rope would in itself weigh nearly six hundered weight, while, by the application of the wire rope, the size of the rope is reduced two-thirds—one of three inches being of equal strength, the weight of which would be less than one-fourth of that of hemp, or say one and a half hundred weight.

A series of experiments will have been made this week, the results of which we hope to note in our next number; in the *interim*, however, we may give those which have attended a trial made within the last few days, as to the comparative strength of iron, both as chain and rod, with that of wire rope, which are as follows:—

	Length. Feet.	Weight. Lbs.	Broke with a strain of Tons	cwt.	qrs.	lbs.
½ inch chain	14	30	4	9	0	0
½ inch rod-iron	14	10	4	4	2	12
½ inch wire rope	14	6	7	6	0	20

We cannot, on the present occasion, enter further into detail, but purpose returning to the subject next week, giving the paper, by M. Albert, referred to, which will be found in the accompanying Number of the *Mining Review.* Ibid.

Novel Railway.

Having, on a late visit to the Polytechnic Institution (which, we are happy to say, is making rapid strides in its advancement to public favour, from the numerous additions which have lately been made to its collections of models and inventions,) had an opportunity of examining two models of Mr. Rangeley's Rotation Railway—for such, we believe, is the title given to the patented invention of this gentleman—we propose briefly noticing it on the present occasion. It may be described in a few words, and as the model is upon a minute scale, without those appliances necessary for judging of its merits, or any advantages it may possess, when practically applied, we can only render to our readers a description, leaving it to those, who may consider it in a scientific point of view, to examine and judge for themselves, while to the public its novelty will at least claim attention, and doubtless, render it an object of attraction to those who frequent this institution. Opinions will, of course, vary, but one will be universal—the importance to be attached to the safety of life—and this, in a great measure, if not entirely, appears to be accomplished by the means projected by the patentee. The "Rotation Railway" consists of a series of wheels in lieu of parallel lines of rails, on which the carriages run—the latter having no wheels, but a plain surface,

which passes over the wheels, indeed, we can only compare it to a railway reversed, the wheels forming the railway, and railway plates being attached to the carriages instead of the wheels. It will, therefore, be understood, that the power employed is not, as in ordinary cases, to the carriages by way of locomotives, but is given to the wheels, the impetus once given to which, set in motion, carries forwards the carriages with a given velocity, which, however, we believe, is not yet determined. It is almost unnecessary to say, that the wheels (around the axles of which a rope passes) are worked by means of stationary engines, placed at contemplated distances of from three to twenty miles—the power for so great a distance being supplied on the pneumatic principle. The model, we have already observed, is upon too minute a scale, more especially in the absence of any calculations or estimates, to form a judgment. The carriages, from their construction, in a great degree, ensure safety from resting upon the wheels, by which about one-third is below the point of bearing. We think Mr. Rangely would do well to submit it to the opinion of scientific and experienced railway engineers, who should be requested to report upon it, and such report, with actual practical results, from experiments on a working scale, if submitted to the public, would, doubtless, effect the object Mr. R. has in view. The model conveys a correct idea of the principle, but its advantages or disadvantages, are by no means developed. We think it worth the attention of some of the companies, or a few individuals, to take up the invention, and test its merits. Mining Jour.

Improvements in Reducing Friction in Wheels of Carriages, which improvements are also applicable to bearings and journals of machinery, patented by Charles Greenway, of Douglas, in the Isle of Man, July 3.

The first claim consists in the method of forming a "cradle" for the reception of spheres or rollers near to which, the arm of the axle is made to rotate, whereby a considerable friction is overcome, as the spheres or rollers do not require an axis, and the cradle is so formed as to keep them close to the axle.—In the description of the second improvement, the inventor states that to the carriage, on which the trunnions of a caronnade are usually fixed, the wheels are not used, in order to prevent recoiling. But in his improvement, wheels are put to the carriage, so as to facilitate the movement of the caronnade towards the port-hole or embrasure; and before the act of firing, the caronnade with its trunnion is moved by the action of a lever from the carriage on to the deck of a vessel to prevent recoiling, and is again restored to the carriage by the same lever, when preparing to reload.—*Inventor's Advocate.* Civ. Eng. & Arch. Jour.

On the use of Mica as a substitute for Glass. By Joseph Glynn, F. R. S., M. Inst. C. E., &c.

In the windows of the workshops at the Butterley Iron Works so much glass was broken by the chippings of iron, that a substitute was sought which should resist a moderate blow, and yet be translucent. A quantity of sheets of mica were procured from Calcutta, which, when fixed into the cast-iron window frames, were found to resist the blow of a chipping of iron driven off by the chisel with such force as would have shivered a pane of glass.

Mica possesses both toughness and elasticity, and when a piece of iron does penetrate it, merely a hole is made large enough to allow the piece to pass, while the other parts remain uninjured. It is not quite so transparent as glass, but it is not so much less as to be objectionable; but this circumstance is not important at Butterley, as in consequence of the quantity of fluoric acid gas evolved from the fluate of lime used as a flux in the blast furnaces, the glass in the windows is speedily acted upon, and assumes the appearance of being ground. Mica is a little more expensive than common glass; but, as its duration promises to be much longer, it must be more economical; and if an extensive use of it could be induced, a more ready supply would be obtained—probably from Pennsylvania, or from Russia, where it is commonly used for windows in farm houses, and also on board ships of war, as it is less liable to be fractured by the concussion of the air during the discharge of heavy artillery. It can be procured of almost any dimensions necessary for ordinary purposes, as it has been found in Russia in masses of nearly three feet diameter. It is susceptible of very minute subdivisions, as, according to Haüy, it may be divided into plates no thicker than one three-hundred-thousandth part of an inch.—*Transactions of Civil Engineers.*

Mining Jour.

Progress of Civil Engineering.

Light Houses.

Captain Basil Hall briefly explained his views as to obtaining for light-houses all the advantages of a fixed light, by means of refracting lenses in revolution.

The difference between a fixed and a revolving light is much in favour of the revolving light, as the light can be concentrated and great brilliancy obtained on any particular point at each succeeding flash;—by a fixed light, being meant, one in which the light is visible on every side; and by a revolving light, one in which the light appears in periodical flashes. Fresnel's fixed light has only one-sixth the brilliancy of his revolving light. Fresnel's system consists in having a large central lamp with four concentric wicks, surrounded by eight lenses, each three feet diameter. The light is thus concentrated and thrown off in eight pencils, which, as they strike the eye successively, have very brilliant effect, and are visible at a great distance.

Captain Basil Hall's inquiries have been directed to ascertain whether the well-known superior brilliancy of a revolving light could not be obtained for a fixed or continuous light; that is for one equally visible in all directions at the same moment. His idea was, that by giving a certain velocity of revolution to a series of lenses round a fixed light, as in Fresnel's arrangement, a continuity of illuminating power, equal almost in brilliancy to that of a slowly revolving light, might be produced. This he expected, would prove true, provided no intensity were then lost. He had erected some apparatus at the Tower, and determined the effect by experiment. The apparatus consisted of a fixed central light with a series of eight lenses, 1 foot diameter and 3 feet focal distance, so arranged as to revolve at any velocity up to 60 revolutions per minute. The light from the central lamp being concentrated by refraction through the eight lenses into eight pencils, having a divergence of about 8° each, illuminated not quite 50° of the hori-

zon when at rest; but when this same system of lenses was put into rapid motion, every degree of the 360° of the horizon became illumined, and to spectators placed all round the horizon, the light would appear continuous and equally brilliant in every direction. The only question would be, whether or not this continuous light is essentially less intense than the light seen through the lenses at intervals when in slow motion. The fact is, that two distinct effects are produced in this experiment—a physical effect in diminishing the brilliancy of the light exactly in proportion to the ratio of the dark portion of the horizon, compared to that of the enlightened portion, viz. as 310° to 50°; and a physiological effect, (suggested by Professor Wheatstone,) by which the sensibility of the retina might be so excited by a succession of bright flashes, that not only a continuity of light might be produced, but a light not much, if at all, inferior in intensity to that caused by the lenses at rest. When first set in motion, the effect is that of a series of brilliant but trembling flashes; as the system of lenses is accelerated in velocity, the steadiness of the light increases with scarcely any apparent diminution of brilliancy. At 44 revolutions per minute absolute continuity is produced, and at 60 revolutions nearly the steadiness of a fixed light. When viewed from the distance of half a mile, the effect is nearly that of continuity, very much resembling that of a fixed star of the first magnitude. The only difference in the quality of the light is, that the lenses being in motion, it resembles a star twinkling violently; and when at rest, it resembles a planet. The difference of intensity had been measured by examining the light through a number of plates of stained glass. Some eyes had seen the light through 13 glasses, the lenses being at rest, and through 12, the lenses being in motion; other eyes, with other glasses, had seen it through 10, the lenses being at rest, and 8, the lenses being in motion. He had seen it through 9, the lenses being in motion, and through ten at rest. He did not pretend to say whether mechanical difficulties might not prevent the adoption of the system; what he aimed at was to establish the principle, that by putting a system of lights into a rapid rotary motion, a continuous light, visible in all directions, would be the result, without any essential diminution of brilliancy, as compared to that of the same lights when viewed at rest. If this principle should prove correct, its application to practice might afterwards be thought of, and left to the ingenuity of the engineer; but if the principle should not be correct, and there was a great loss of light by the rotary motion, then it would be useless to go on.

Mr. Parkes observed, that he could entirely confirm the account of the experiments with revolving lenses given by Captain Basil Hall on a preceding evening. It appeared to him, that when the lenses made 32 revolutions, the light was not quite continuous; but at 40 revolutions it was perfectly so, although the general effect was twinkling. The central spot was very distinct; he saw the light equally as distinctly through 10 coloured glasses, the lenses being in motion, and through 11, the lenses being at rest. He would suggest, whether the tremulous appearance of the light might not be in part accounted for by the slightness of the revolving frame, which, at the required velocity vibrates considerably. In the temporary apparatus erected at the Tower, one man could maintain about 40 revolutions per minute.

Mr. Alexander Gordon remarked, the coincidence of the experiments of Captain Basil Hall, with a law of light as laid down by writers on optics,—viz., that if a luminous body pass the eye eight times in one second, the impressions are blended so as to produce the appearance of continuity, or

that the duration of an impression on the retina may be taken at about one eighth of a second. Now, in the apparatus erected by Captain Basil Hall, there are eight lenses, and continuity of light is produced when the frame makes 60 revolutions a minute. Thus, eight lenses flash across the eye in one second, and the observed result is a remarkable confirmation of the law alluded to.

Mr. Hawkins thought the light was better and steadier at 40 revolutions than at any other speed. When observing the reflection of the light on the features of the by-standers, he saw them very distinctly, the lenses being at rest; but from the moment of commencement of motion, there was a visible diminution in the intensity of the light, which increased with the speed. He saw the light, the lenses being at rest, through 10 coloured glasses, and through 9 when in motion.

Mr. Macneill thought the light was steadier at 60 than at 40 revolutions. The shadow was less intermittent. He did not conceive the mode of examining the intensity of the light through coloured glasses to be so correct as by observing the depth of the shadow, as the eye was capable of judging more correctly of the relative intensity of shadows than of lights. When the lenses were in rapid motion, there appeared a dark spot in the centre of a luminous disc.

Professor Keating, of Philadelphia, stated that the dark spot in the centre appeared as if he saw the wick of the lamp. The lenses being at rest, the light was uniform; but on their acquiring a certain degree of velocity, its whiteness diminished; until at 40 revolutions, a decided orange tint appeared, and at 60 revolutions both the orange hue and the centre dark spot increased.

Mr. Lowe inquired whether the quantity or intensity of light was most required for light-houses. The conflicting opinions of experimenters on the intensity of light, as ascertained by the photometers now in use, show that some better test or means of comparison is wanted. He should conceive that pieces of coloured glass could not afford any accurate measurement of the space-penetrating power of light at so small a distance as 345 feet, which he understood was the length of the room in which these experiments were tried. The depth of shadows also furnished no adequate measure of the intensity of light, for shadows were differently coloured for different lights. Perhaps the photogenic paper might furnish the tests and means of comparison now so much wanted.

The President remarked on the advantages of the revolving lights, as apart from the greater brilliancy, in that they are peculiarly useful as being easily distinguished from land and other lights, which tend to mislead mariners. There may be peculiar advantage in the tremulous character of Captain Basil Hall's light, as enabling it to be more easily distinguished among others. It is not simply the quantity of light which is diffused over the horizon which is valuable, but the intensity of the ray in a certain direction, which, falling on the eye, rivets immediate attention.

Lond. Jour. Arts and Sci.

Railway Telegraphs.

Mr. Saunders, the secretary of the Great Western Railway, states the expense of constructing the electrical telegraph on the line of that railway to have been from £250 to £300 a mile. This description of telegraph, however, when once constructed, is worked at a very trifling expense,

whereas the telegraph now in use between London and Portsmouth, independent of the original outlay, costs about £3,300 a year, and the lines of telegraphic communication to Plymouth, to Yarmouth, and to Deal, were abandoned in the year 1816, on account of the expenditure required for their maintenance.

Whenever a telegraph shall have been laid down between London and the other ports and mercantile cities of the island, it will give to its proprietors great advantages in obtaining and transmitting information, which must be attended with most important results. For the purposes of the railway itself, this telegraph may also be frequently used to prevent the risk of accidents and to obviate delay and inconvenience.

Your committee are of opinion that circumstances may arise in which it may be very inconvenient to leave in the hands of a private company, or possibly of an individual, the exclusive means of intelligence which this telegraph will afford; and it cannot fail to be of paramount importance that the government should be furnished with similar means of procuring and transmitting intelligence, and they believe that no Railway Company will object on fair terms to give every facility to the government for establishing a line of electrical communication over the whole length of their railway.

Your committee are aware that they have not fully developed the great and increasing importance of this subject, which perhaps does not fall strictly within the terms of the subject-matter referred to them, but they are most anxious to fix the attention of the House and of the public on a discovery which is no less susceptible of useful than of dangerous application.

Civ. Eng. and Arch. Jour.

New Railway Locomotive, invented and constructed by Mr. Walter Hancock, *of Stratford, Essex; now on trial on the Eastern Counties' Railway.*

One of the principal advantages of this locomotive is presented in the boiler, by which steam of greater power is generated with far greater certainty of continued supply, and more perfect safety, than by the boilers now in use, either in railway, marine, or stationary engines. This boiler is constructed of a number of distinct chambers, each chamber composed of several tubes. Each chamber, or rank of tubes, connects with two general cylinders, or reservoirs—one at the bottom for the supply of water, and the other at the top for the reception and passage of steam. The communications from each chamber to the water, steam pipes or reservoirs, have self-acting valves. When any leakage occurs, from wear, rents, or other causes, to any one chamber, the valves belonging to it close, and are kept to their seats by the pressure of the water and steam contained in the neighbouring sound chambers, and the boiler remains as effective as before, excepting that the surface of that one chamber, is thrown out of use, without stopping the engines, and perhaps it would not be observed by the engine driver until the end of the trip, when the pressure being reduced by withdrawing the fire, the valve would fall from its seat, and point out the defective chamber by the discharge of water. In half an hour a new chamber could be attached in its stead. In the ordinary locomotive boiler, when any of its tubes become defective, the whole is rendered inoperative by reason of the unchecked communication of all the parts with each other, and so it remains until the defective tube is repaired, replaced, or plugged, which generally occupies three or four hours, and is attended besides with the inconvenience of stopping the train until another engine is procured from the next station.

By adopting the improved boiler no such delay would occur, and the expense both in fuel and wages, of keeping a number of engines with their fires up ready to meet such casualties, would be avoided, as well as the risk when a train stops out of time, and having another train brought in collision with it, and the lives of passengers and attendants endangered.

The great heating surface obtained in a comparatively small space, is likewise a recommendation to this boiler. It is intended to attach a reciprocating set of fire bars to it, by which a clean floor of bars can be introduced without lowering the fire. The small weight of this boiler in comparison to its generating power, is another material point in its favour, for it leaves room for giving sufficient strength to all other parts, without exceeding the present total weight of a locomotive.

Having given a general description of the power—the engines and machinery come next under consideration.

The engines of the present locomotives are placed horizontally, and are thereby very much confined and difficult of access, but in this one they are vertical, and therefore the whole of the machinery, pumps, &c., are open to view, can be readily oiled, and speedily detached for repairs; or any portion may be put right and secured whilst the engines are working.

The engines of this locomotive give motion to a separate crank shaft, and this communicates the progressive motion to the wheel axle by an endless chain, working over a pulley fixed on each, and which two pulleys may be either of equal or different diameters, so that advantage may be obtained either for speed or power, whichever may be required. This arrangement not only allows the wheel axle to be straight instead of cranked, but it also possesses the advantages of a moderate accommodation or play, by which all sudden jerks or concussions of the machinery, &c., are avoided.

The friction is reduced to above one-half, from such large excentrics, crank-bearings, &c., not being required, in consequence of the weight of the machinery, boiler, &c., being on straight instead of cranked axles.

This arrangement allows the wheels to be immediately thrown out of gear, so that the engines will work the injection pumps, and get up the fire, without working the driving wheels. By running locomotives about, to effect these purposes, much of unnecessary wear and tear is incurred, besides running on the rails in the way of trains, &c. The present locomotive need not stir from the spot until the train is attached—the clutch then thrown in, it immediately starts upon its trip.—*Correspondent of the Railway Times.*

Ibid.

Improved Land Surveying Chain.

Sir—Observing in a former number of your Journal a description of an improved surveying pole, I venture to trouble you with an account of what I consider an improvement which I have lately made in the chain, namely, having the 11th, 21st, 31st, and 41st links made of brass, the rest being of iron; by this arrangement the brass link, being in all cases nearer the middle of the chain than the token, will at once point out whether such token be 10 or 90, 60 or 40, &c., and as a matter of course the liability to mistake 40 for 60, and so, entirely done away with. In mineral surveying a chain of this construction is incalculably superior to one of the old.

If you think the hint is likely to be useful to any of your readers, I shall feel obliged by your giving it a place in the Journal.

Barnsley, Aug. 3, 1840. William James Hindle.

Ibid.

To the Readers of the Journal.

The next number of this Journal will be the commencement of a New Series, and efforts have been made to improve both the intellectual and mechanical departments of the work. These arrangements will be announced in the January number. They will unavoidably produce a short delay in the publication of that number, but it is expected to be presented to subscribers soon after the middle of the month. The Professors of the Franklin Institute and other friends of Science have undertaken to aid the Committee in their proposed improvements, and an entire new fount of type will clothe these contributions in a suitable dress. The deductions from the experiments on Water Wheels will appear in the new series of the Journal, the first number being prepared for February next. Com. Pub.

Meteorological Observations for September, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	60	75	29.90	29.90	W.	Moderate.		Clear—do.
	2	60	80	.84	.84	N.W.	do.	.10	Clear—rain;
☾	3	60	58	.80	.80	N.W.	do.		Cloudy—do.
	4	56	66	.96	.96	N.E.	do.		Clear—cloudy.
	5	58	58	.90	.90	N.E.	do.	.59	Cloudy—rain.
	6	57	70	.90	.90	W.	do.		Flying clouds—clear.
	7	56	75	30.05	30.05	W.	do.		Clear—do.
	8	60	75	29.96	29.96	W.	Brisk.		Cloudy—clear:
	9	65	77	.95	.95	S.	Moderate.		Cloudy—do.
☉	10	67	71	.75	.75	S.W.	do.	.18	Cloudy—rain.
	11	56	62	.60	.66	W.	Brisk.		Clear—flying clouds.
	12	48	64	30.00	30.00	W.	do.		Clear—do.
	13	48	67	.20	.20	W.	Moderate.		Clear—flying clouds.
	14	48	69	.15	.15	W.	do.		Clear—do.
	15	54	76	29.94	29.94	W.	do.		Clear—do.
	16	56	77	.93	.93	W.	do.		Lightly cloudy—clear.
☽	17	56	74	.95	.95	S.	Brisk.		Fog—lightly cloudy.
	18	64	67	.75	.75	S.W.	Moderate.	1.00	Rain—do.
	19	56	62	.77	.77	W.	do.		Clear—flying clouds.
	20	48	70	.65	.65	W.	Brisk.	.10	Clear—do.—showery.
	21	50	58	.65	.65	N.W.	Moderate.		Clear—do.
	22	38	57	30.15	30.15	N.W.	do.		Frost—clear.
	23	42	67	.15	.15	W.	do.		Clear—do.
	24	52	68	.20	.20	E.	do.		Clear—do.
⊗	25	48	68	.26	.20	S.E.	do.		Clear—do.
	26	46	68	.26	.20	E.S.W.	do.		Fog—clear.
	27	55	65	29.93	29.93	S.	do.		Cloudy—rain.
	28	48	64	.98	.98	N.W.	do.		Clear—do.
	29	47	67	30.10	30.10	N.W.	do.		Lightly cloudy—hazy.
	30	50	66	29.95	29.95	W.	do.		Lightly cloudy—do.
	Mean	53.43	64.70	29.95	29.95			1.970	

	Thermometer.		Barometer.	
Maximum height during the month.	80.	on the 2nd.	30.20 on	the 13th 24th 25th & 26th.
Minimum " "	38.	on the 22nd.	29.65 "	20th & 21st.
Mean	39.06		29.95	

	Colla olo va	Ba 9, P. M.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
1	Pl	29.	4 1/3	2/3	1 1/3	2 2/3	4 2/3	1/8	.	2 1/3	....	.	....	....	.	1059
2	M															
3	Bl	29.	5 2/3	1	.	1/3	8	1 1/3	.	1/3	....	.	.....	....	.	1062
4	Le															
5	N															
6	Mi	29.	4	.	2 1/3	.	3 1/3	.	.	9 2/3	....	.	.....	....	.	1096
7	Pr															
8	W															
9	Su	27.	1	.	6 1/3	.	3	.	9 1/3	3	....	.	.....	....	.	1113
10	Lu															
11	Sc															
12	Be															
13	Ch															
14	De															
15	La	29.	2 1/3	2/3	1 2/3	.	5	1 2/3	.	1/3	56.23	1	.....	62.37	1	1069
16	Yo															
17	Le															
18	Da															
19	Ne	29.	1	.	3 1/3	.	3	1/3	2 1/3	.	....	.	.....	63.79	.	1060
20	Co	29.	4	2/3	1/3	.	1	.	7 2/3	9 1/2	....	.	.....	...	.	1029
21	Br															
22	Ti															
23	Ly															
24	Ur															
25	Mi															
26	Ju	29.	2	.	2/3	.	3	.	11 1/3	3 2/3	....	.	.....	....	.	1064
27	Po															
28	Cu	29.	1	2/3	3 1/3	2/3	3 1/3	1	11	.	....	.	.....	....	.	1156
29	Ad	29.	5	1/3	1	2/3	5	1/3	.	.	....	.	.....	....	.	1144
30	Fr															
31	Hu	29.	.	.	16 1/3	.	.	.	.	.	....	.	.....	....	.	1088
32	Co	29.	5	.	3	.	7	.	.	4 1/3	....	.	.....	....	.	1092
33	Po															
34	M	28.	1 1/3	.	15 2/3	.	3 2/3	.	.	3 2/3	....	.	.....	64.36	6	1095
35	Cl															
36	Ca	27.	2 2/3	.	6 2/3	2/3	5 1/3	.	4 1/3	2	....	.	.....	...	.	1067
37	Be	29.	1 1/3	2	2	7 2/3	4	1/3	.	.	....	.	.. .	....	.	1093
38	So	27.	1	4 1/3	1 1/3	1 2/3	1	.	12 1/3	1/3	....	.	.....	....	.	1078
39	Ind	28.	3 1/3	.	1 1/3	.	6	.	10	.	....	.	...	....	.	1068
40	Jef															
41	W	28.	1 2/3	.	2 1/3	.	1/3	.	14 1/3	2/3	....	.	....	....	.	1079
42	Ve	...	2/3	.	.	.	5	.	.	20 2/3	....	.	.....	....	.	1094
43	Ar															
44	W															
45	Fa	28.	7 2/3	.	6 1/3	.	1/3	.	5	.	....	.	.....	....	.	1267
46	Gr															
47	W	29.	8	.	4 1/3	.	4	.	.	7 2/3	....	.	.....	....	.	1080
48	Al	29.	3 2/3	1 2/3	4	1 2/3	5	2/3	.	.	....	.	.....	....	.	1063
49	Be	29.	1 1/3	1 1/3	1	.	8 1/3	2/3	7	2/3	....	.	.....	....	.	1227
50	Bu	28.	8	.	5 2/3	.	1 2/3	.	.	.	....	.	.....	....	.	1083
51	Me	28.	.	.	2/3	.	1	.	10 1/3	1/3	77.61	5	.....	52.58	.	1165
52	Cr	28.	1 2/3	.	3 1/3	.	4 2/3	.	5	3	....	.	.....	....	.	1081
53	Eri	29.	1 1/3	3	3 1/3	2 1/3	2	1/3	3 2/3	.	....	.	.....	....	.	1177

METEOROLOGICAL REPORT
FOR THE STATE OF PENNSYLVANIA.
Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for
MAY, 1840.

County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Days omitted.
1 Philadelphia.	Philadelphia.	J. M. Hamilton.	63.41	71.06	65.14	86.00	46.00	66.54	3	39.00	52.82	3
2 Montgomery.												
3 Bucks.	Newtown.	L. H. Parsons.	60.05	68.52	54.30	84.25	40.50	60.96	.	37.00	48.85	.
4 Lehigh.												
5 Northampton.	Easton.	Lafayette College.										
6 Monroe.	Stroudsburg.	A. M. Stokes.	51.34	72.15	57.44	90.	36.00	60.38	11⅔	....	....	.
7 Pike.												
8 Wayne.												
9 Susquehanna.	Silver Lake.	E. Rose.	53.89	71.61	58.41	88.	32.00	61.30	3	28.00	47.25	3
10 Luzerne.	Wilkesbarre.	W. F. Dennis.										
11 Schuylkill.												
12 Berks.	Reading.	C. F. Egelmann.										
13 Chester.												
14 Delaware.	Haverford.	Haverford School.										
15 Lancaster.	Lancaster.	Conservatory of Arts.	57.94	72.45	60.58	86.	40.50	63.66	⅓	38.00	52.84	.
16 York.												
17 Lebanon.												
18 Dauphin.												
19 Northumberland.	Northumberland.	Andrew C. Huston.	58.32	68.60	61.39	83.	40.00	62.77	.	34.00	47.13	.
20 Columbia.	Danville.	C. H. Frick.	57.46	75.62	62.18	87.	46.00	65.09	8⅔	33.00	51.65	8
21 Bradford.												
22 Tioga.												
23 Lycoming.												
24 Union.												
25 Mifflin.												
26 Juniata.	Mifflintown.	J. A. Rinkead.	49.01	71.14	57.86	90.	32.00	59.35	3	....	....	.
27 Perry.												
28 Cumberland.	Carlisle.	Prof. W. H. Allen.	56.84	70.29	59.29	86.	37.00	62.14	.	36.00	50.87	.
29 Adams.	Gettysburg.	Prof. M. Jacobs.	56.83	70.43	58.56	87.50	38.00	61.94	.	35.50	49.23	.
30 Franklin.												
31 Huntingdon.	Huntingdon.	Jacob Miller.	57.13	72.19	58.29	89.	39.00	62.54	.	....	....	.
32 Centre.	Bellefonte.	John Harris.	52.47	72.40	57.72	92.	35.00	60.86	4⅓	....	....	.
33 Potter.												
34 M'Kean.	Smithport.	Richard Chadwick.	48.84	72.00	48.35	94.00	34.00	56.40	1⅔	27.00	40.00	.
35 Clearfield.												
36 Cambria.	Ebensburgh.	Richard Lewis.	51.42	66.87	53.87	90.00	32.00	57.39	2	29.00	44.81	4
37 Bedford.	Bedford.	Samuel Brown.	59.91	69.37	63.58	87.00	38.40	64.29	.	....	....	.
38 Somerset.	Somerset.	George Mowry.	54.31	63.83	54.82	81.50	36.00	57.65	⅓	33.50	48.18	.
39 Indiana.	Indiana.	Richard White.	68.35	71.35	54.61	96.00	36.00	64.77	.	28.00	45.22	8
40 Jefferson.	Rose Cottage.	C. C. Gaskell.										
41 Warren.	Warren.	C. S. Brown.	56.68	68.73	63.86	88.00	39.00	63.19	.	36.00	47.10	5
42 Venango.	Franklin.	Wm. Connely.	46.	74.48	61.45	95.00	24.00	60.64	.	....	....	.
43 Armstrong.												
44 Westmoreland.												
45 Fayette.	Uniontown.	J. P. Weithers.	59.37	71.55	60.58	92.00	36.00	63.83	.	....	....	.
46 Green.												
47 Washington.	Cannonsburg.	Jno. H. Kennedy.	49.13	73.94	59.16	92.00	33.00	60.74	.	33.00	49.00	.
48 Allegheny.	Pittsburgh.	G. P. Schiveley.	58.84	70.05	60.97	87.00	40.00	63.29	.	....	....	.
49 Beaver.	Beaver.	Wm. Allison.	60.74	70.49	65.93	86.00	48.00	65.69	⅔	....	....	.
50 Butler.	Butler.	Jacob Mechling.	55.74	73.65	63.65	89.00	40.00	64.35	.	....	....	.
51 Mercer.	West Greenfield.	S. Campbell.	69.35	71.25	60.53	90.00	42.00	64.05	.	42.00	58.05	.
52 Crawford.	Meadville.	J. Limber.	60.69	70.00	60.67	91.00	42.00	63.79	1⅓	33.00	48.17	1
53 Erie.	Erie.	Park & Reid.	59.32	65.42	57.00	82.00	39.00	60.58	1	28.00	47.02	1

County.	Barometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Weather. Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.
1 Philadelphia.	30.00	29.93	29.99	30.47	29.35	29.97	2⅔	20	6⅔	4⅓	....	....	....	..	....
2 Montgomery.															
3 Bucks.	29.87	29.88	29.89	30.37	29.07	29.88	.	17⅓	12	1⅔	8	....	....	..	3.906
4 Lehigh.															
5 Northampton.															
6 Monroe.	29.46	29.46	29.45	29.90	28.75	29.46	9⅔	8⅓	11⅓	11⅓	7	....	....	..	2.950
7 Pike.															
8 Wayne.															
9 Susquehanna.	27.99	27.99	27.96	28.50	27.25	27.98	3	14⅔	10⅔	5⅓	4	....	....	..	1.670
10 Luzerne.															
11 Schuylkill.															
12 Berks.															
13 Chester.															
14 Delaware.															
15 Lancaster.	29.45	29.44	29.45	29.90	28.74	29.45	⅓	19⅓	11⅓	⅓	7	....	....	..	2.030
16 York.															
17 Lebanon.															
18 Dauphin.															
19 Northumberland.	29.39	29.33	29.38	29.82	28.63	29.37	.	14	17	.	11	....	....	1	2.731
20 Columbia.	29.40	29.40	29.38	29.60	28.00	29.40	8⅔	11⅓	11	8⅔	....	....	....	..	.....
21 Bradford.															
22 Tioga.															
23 Lycoming.															
24 Union.															
25 Mifflin.															
26 Juniata.	29.39	29.36	29.38	29.83	28.14	29.38	3	14⅔	12⅔	3⅓	8	....	....	..	3.190
27 Perry.															
28 Cumberland.	29.31	29.29	29.29	29.72	29.64	29.30	.	16⅔	14⅓	.	11	....	....	..	2.422
29 Adams.	29.35	29.35	29.33	29.74	28.68	29.34	.	17⅔	13⅓	.	8	....	....	2	2.638
30 Franklin.															
31 Huntingdon.	29.29	29.28	29.25	29.68	28.62	29.24	.	17	14	.	10	.	....	..	3.272
32 Centre.	29.24	29.22	29.20	29.90	29.46	29.22	3⅔	14	12⅔	4⅓	.	.	....	..	5.770
33 Potter.															
34 M'Kean.	28.09	28.11	28.10	28.55	27.23	28.10	1⅔	17	12⅓	1⅔	.	.	....	..	2.482
35 Clearfield.															
36 Cambria.	27.78	27.78	27.78	28.12	27.10	27.78	2	10⅔	17⅔	2⅔	10	2	....	..	4.458
37 Bedford.	29.19	29.14	29.12	29.57	28.48	29.15	.	15	16	.	.	.	....	..	......
38 Somerset.	27.93	27.91	27.91	28.23	27.30	27.92	⅓	13	17⅓	⅔	9	1	....	..	3.975
39 Indiana.	28.59	28.56	28.55	28.90	27.90	28.57	.	17	14	.	12	....	....	..	3.180
40 Jefferson.															
41 Warren.	28.79	28.79	28.79	29.16	28.10	28.79	.	19⅔	11⅓	.	5	....	...	1	1.367
42 Venango.	....	29.02	....	29.90	28.44	29.02	20⅓	7⅓	3	20⅔	10	....	....	..	3.423
43 Armstrong.															
44 Westmoreland.															
45 Fayette.	28.94	28.91	28.93	29.80	28.09	28.93	.	22⅔	8⅓	.	....	....	....	..	......
46 Green.															
47 Washington.	28.97	29.00	29.00	29.63	28.08	29.00	.	.	.	.	10	....	....	..	4.172
48 Allegheny.	29.19	29.17	29.18	29.50	28.55	29.18	.	19⅔	11⅓	.	....	....	....	..	......
49 Beaver.	29.34	29.30	29.37	29.70	28.66	29.34	⅓	15⅓	15	⅔	....	....	....	..	3.190
50 Butler.	28.81	28.80	28.82	29.10	28.30	28.81	.	20	11	.	8	....	....	..	3.750
51 Mercer.	28.67	28.65	28.62	28.94	28.05	28.65	⅓	17⅓	13⅓	⅓	11	....	....	..	2.980
52 Crawford.	28.67	28.67	28.67	28.97	28.00	28.67	1⅓	15	14⅔	1⅓	11	....	....	..	2.983
53 Erie.	29.46	29.43	29.46	29.80	29.06	29.45	.	22	9	.	6	....	....	2	2.190

County.	Winds. North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
1 Philadelphia.	1	1⅓	6⅓	.	2	1	2	1	⅔	1⅓	4⅓	⅔	1⅓	2⅔	4⅔	⅓	.	2½	....	.	....	....	.	1059
2 Montgomery.																								
3 Bucks.	⅔	⅔	4⅔	1⅓	.	⅔	4⅓	1	⅔	⅓	5⅔	1	.	⅓	8	1⅓	.	⅓	....	.	.....	....	.	1062
4 Lehigh.																								
5 Northampton.																								
6 Monroe.	2⅓	.	1	.	4	.	1⅔	.	2⅔	.	4	.	2⅓	.	3⅓	.	.	9⅔	....	.	.....	....	.	1096
7 Pike.																								
8 Wayne.																								
9 Susquehanna.	.	.	.	.	⅓	.	8	.	.	.	1	.	6⅓	.	3	.	9⅓	3	....	.	.....	....	.	1113
10 Luzerne.																								
11 Schuylkill.																								
12 Berks.																								
13 Chester.																								
14 Delaware.																								
15 Lancaster.	1⅔	⅔	2⅔	⅓	5	1	4	⅔	1⅓	1⅔	2⅓	⅔	1⅔	.	5	1⅔	.	⅓	56.23	1	.....	62.27	1	1069
16 York.																								
17 Lebanon.																								
18 Dauphin.																								
19 Northumberland.	3⅓	⅓	2⅓	⅓	⅔	.	5⅓	1⅔	6⅔	.	1	.	3⅓	.	3	⅓	2⅓	.	....	.	.....	63.79	.	1060
20 Columbia.	⅔	.	⅔	.	⅔	.	3⅓	.	2⅔	.	4	⅔	⅓	.	1	.	7⅔	9½	....	.	.....	...	.	1029
21 Bradford.																								
22 Tioga.																								
23 Lycoming.																								
24 Union.																								
25 Mifflin.																								
26 Juniata.	⅔	.	1⅓	.	3	.	5⅓	.	.	.	2	.	⅔	.	3	.	11⅓	3⅔	....	.	....	....	.	1064
27 Perry.																								
28 Cumberland.	⅔	⅓	1⅔	.	2⅓	⅓	3	.	1⅔	.	1	⅔	3⅓	⅔	3⅓	1	11	.	....	.	.....	....	.	1156
29 Adams.	2⅓	.	4⅓	.	1	⅓	7⅓	⅓	1⅓	1⅓	5	⅓	1	⅔	5	⅓	.	.	....	.	.....	....	.	1144
30 Franklin.																								
31 Huntingdon.	.	.	.	.	14⅔	.	.	.	.	.	.	.	16⅓	.	.	.	.	.	....	.	.....	....	.	1088
32 Centre.	⅔	.	3⅓	.	1	.	5	.	1⅔	.	5	.	3	.	7	.	.	4⅓	....	.	.....	....	.	1092
33 Potter.																								
34 M'Kean.	⅓	.	⅓	.	1⅓	.	4⅔	.	⅓	.	1⅓	.	15⅔	.	3⅔	.	.	3⅔	....	.	.....	64.36	6	1095
35 Clearfield.																								
36 Cambria.	⅔	.	1⅓	.	⅔	⅓	4⅓	.	2	.	2⅔	.	6⅔	⅔	5⅓	.	4⅓	2	....	.	.....	..	.	1067
37 Bedford.	.	.	.	.	.	.	1⅔	10	.	2	1⅓	2	2	7⅔	4	⅓	.	.	....	.	.....	....	.	[illegible]
38 Somerset.	⅔	.	⅔	.	1	.	5⅔	.	1	.	1	4⅓	1⅓	1⅔	1	.	12⅓	⅓	....	.	.....	....	.	1078
39 Indiana.	.	.	⅔	.	1⅓	.	8	.	.	.	3⅓	.	1⅓	.	6	.	10	.	....	.	...	....	.	1068
40 Jefferson.																								
41 Warren.	1⅓	⅓	1⅔	.	1	.	6	⅓	1	.	1⅔	.	2⅓	.	⅓	.	14⅓	⅔	....	.	....	....	.	1079
42 Venango.	.	.	.	.	1	.	3⅔	.	.	.	⅔	.	.	.	5	.	.	20⅔	....	.	.....	....	.	1094
43 Armstrong.																								
44 Westmoreland.																								
45 Fayette.	⅓	.	4	.	⅓	.	5	.	2	.	7⅔	.	6⅓	.	⅓	.	5	.	....	.	.....	....	.	1067
46 Green.																								
47 Washington.	.	.	1	.	2⅓	.	3⅓	.	⅓	.	8	.	4⅓	.	4	.	.	7⅔	....	.	.....	....	.	1080
48 Allegheny.	.	⅓	⅓	.	⅔	2⅔	4	⅓	4⅔	1⅓	3⅔	1⅔	4	1⅔	5	⅔	.	.	....	.	.....	....	.	1063
49 Beaver.	1	.	3⅓	2⅓	⅓	⅓	3	.	.	.	1⅓	1⅓	1	.	8⅓	⅔	7	⅔	....	.	.....	....	.	[illegible]
50 Butler.	.	.	3⅓	.	10⅔	.	1	.	⅔	.	8	.	5⅔	.	1⅔	.	.	.	....	.	.....	....	.	1083
51 Mercer.	5⅔	.	.	.	2	.	2	.	9	.	.	.	⅔	.	1	.	10⅓	⅓	77.61	5	.....	52.58	.	1165
52 Crawford.	3⅔	.	⅔	.	2	⅓	2⅓	⅔	3	⅔	1⅔	.	3⅓	.	4⅔	.	5	3	....	.	.....	....	.	1081
53 Erie.	1⅓	⅓	5⅓	3⅓	.	⅓	⅔	⅔	2⅓	⅔	1⅓	3	3⅓	2⅓	2	⅓	3⅔	.	....	.	.....	....	.	1177

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Collat… olog… van…

										Hygrometer.					
		S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
	—.	$4\frac{2}{3}$	$\frac{2}{3}$	3	$1\frac{1}{3}$	$5\frac{2}{3}$	.	.	$1\frac{1}{3}$	....	.	....	....	.	1207
1	Ph														
2	Md9	$6\frac{1}{3}$	1	2	1	9	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	....	.	.....	....	.	1175
3	Bu														
4	Le..	.	.	.	.	.	.	.	.	....	.	.. ..	....	.	1109
5	Nd9	$2\frac{1}{3}$	.	$2\frac{1}{3}$	.	$3\frac{1}{3}$	.	$\frac{2}{3}$	14	....	.	.....	....	.	1110
6	Mc														
7	Pil														
8	W														
9	Su														
10	Lu														
11	Scl9	$1\frac{2}{3}$	.	$5\frac{1}{3}$	$\frac{2}{3}$	$14\frac{2}{3}$	.	$1\frac{2}{3}$	.	....	.	......	....	.	1101
12	Be														
13	Ch9	$5\frac{1}{3}$	$\frac{1}{3}$	$4\frac{1}{3}$	2	$2\frac{1}{3}$	$\frac{2}{3}$	$3\frac{1}{3}$	$2\frac{1}{3}$	56.62	6	.....	....	.	1111
14	De9	$4\frac{1}{3}$	$\frac{1}{3}$	$2\frac{2}{3}$	$1\frac{1}{3}$	$3\frac{1}{3}$	$1\frac{2}{3}$	.	.	62.86	.	.....	66.83	.	1107
15	La														
16	Yc														
17	Le														
18	Da9	$\frac{1}{3}$	$\frac{1}{3}$	4	.	$5\frac{2}{3}$	$\frac{1}{3}$	$2\frac{1}{3}$	.	....	.	.....	68.75	.	1097
19	Nc														
20	Cc														
21	Br														
22	Ti														
23	Ly														
24	Ur														
25	Mi9	$2\frac{1}{3}$	.	$2\frac{2}{3}$	.	$5\frac{1}{3}$	.	$12\frac{2}{3}$	$2\frac{1}{3}$	....	.	.....	....	.	1099
26	Ju														
27	Pe9	$2\frac{2}{3}$	.	$7\frac{2}{3}$	$\frac{1}{3}$	$3\frac{2}{3}$	.	10	.	....	.	.....	....	.	1156
28	Cu9	$3\frac{2}{3}$	1	$4\frac{1}{3}$	$\frac{1}{3}$	$3\frac{1}{3}$	$\frac{1}{3}$	5	$\frac{1}{3}$	54.94	12	.....	65.11	12	1145
29	Ac														
30	Fr9	.	.	$18\frac{2}{3}$	.	.	.	.	$\frac{1}{3}$	....	.	.....	....	.	1166
31	Hi9	$7\frac{2}{3}$	.	$3\frac{1}{3}$	.	$6\frac{1}{3}$	.	.	4	....	.	.....	....	.	1167
32	Cc														
33	Pc7	8	.	$10\frac{2}{3}$	.	$3\frac{2}{3}$	.	.	2	....	.	.....	70.03	1	1203
34	M														
35	Cl														
36	Ca8	$\frac{1}{3}$	.	$14\frac{2}{3}$	$\frac{1}{3}$	$2\frac{2}{3}$	.	.	.	....	.	.. .	....	.	1103
37	Be7	$8\frac{2}{3}$	$\frac{1}{3}$	$2\frac{2}{3}$	$1\frac{1}{3}$	$2\frac{1}{3}$	.	$10\frac{2}{3}$	$\frac{1}{3}$	....	.	.....	....	.	1102
38	Sc8	5	.	$2\frac{2}{3}$	.	$6\frac{2}{3}$	.	$12\frac{2}{3}$	.	....	.	...	....	.	1108
39	In														
40	Je8	$6\frac{1}{3}$	$\frac{2}{3}$	$1\frac{2}{3}$	.	$2\frac{2}{3}$	.	$10\frac{2}{3}$	.	....	.	....	....	.	1105
41	W8	.	.	.	.	6	.	.	$22\frac{1}{3}$	....	.	.....	....	.	1106
42	Ve														
43	Ai														
44	W8	$12\frac{2}{3}$	.	3	.	$3\frac{2}{3}$	.	$2\frac{1}{3}$	.	....	.	.....	....	.	1268
45	Fa														
46	Gi														
47	W														
48	A9	3	$1\frac{2}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	12	.	7	$1\frac{1}{3}$	....	.	.....	....	.	1228
49	B8	$8\frac{1}{3}$	.	7	.	5	.	.	.	....	.	.....	....	.	1100
50	Bi														
51	M8	$3\frac{1}{3}$	$\frac{1}{3}$	$3\frac{1}{3}$	$\frac{1}{3}$	8	.	3	$1\frac{2}{3}$	....	.	.....	....	.	1112
52	C9	$1\frac{2}{3}$	$\frac{2}{3}$	$7\frac{1}{3}$	1	3	1	7	.	....	.	.....	....	.	1178
53	Er														

METEOROLOGICAL REPORT FOR THE STATE OF PENNSYLVANIA.

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

JUNE, 1840.

No.	County.	Town.	Observer.	Therm. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.
1	Philadelphia,	Philadelphia,	J. M. Hamilton,	69.41	76.86	71.87	87.00	54.50	72.71	1⅓	48.00	61.32	2
2	Montgomery,												
3	Bucks,	Newtown,	L. H. Parsons,	70.20	76.10	64.30	88.00	52.00	70.20	.	42.00	56.08	2
4	Lehigh,												
5	Northampton,	Easton,	Charles Elliot,	62.83	72.42	65.00	85.00	49.00	66.82	1	....	....	.
6	Monroe,	Stroudsburg,	A. M. Stokes,	63.82	78.75	58.67	90.00	46.00	67.08	15	....	....	.
7	Pike,												
8	Wayne,												
9	Susquehanna,	Silver Lake,	E. Rose,										
10	Luzerne,	Wilkesbarre,	W. F. Dennis,										
11	Schuylkill,												
12	Berks,	Reading,	C. F. Egelmann,	66.00	71.83	64.80	87.00	50.00	67.54	.	...	...	.
13	Chester,												
14	Delaware,	Haverford,	Haverford School,	72.50	79.00	73.50	86.00	60.00	75.00	22	47.00	59.97	1
15	Lancaster,	Lancaster,	Conservatory of Arts,	66.07	78.22	67.32	89.00	53.00	70.54	.	46.50	65.08	.
16	York,												
17	Lebanon,												
18	Dauphin,												
19	Northumberland,	Northumberland,	Andrew C. Huston,	66.85	74.53	67.70	85.00	54.50	69.69	.	40.00	53.42	.
20	Columbia,	Danville,	C. H. Frick,										
21	Bradford,												
22	Tioga,												
23	Lycoming,												
24	Union,												
25	Mifflin,												
26	Juniata,	Mifflintown,	J. A. Rinkead,	58.84	77.36	66.65	87.00	51.00	67.62	2⅔	....	....	.
27	Perry,												
28	Cumberland,	Carlisle,	Prof. W. H. Allen,	66.80	78.20	65.97	92.00	53.00	70.32	.	45.00	58.70	.
29	Adams,	Gettysburg,	Prof. M. Jacobs,	64.52	77.56	67.57	91.00	54.00	69.82	.	45.00	58.05	.
30	Franklin,												
31	Huntingdon,	Huntingdon,	Jacob Miller,	62.30	79.17	66.20	91.00	48.00	69.22	⅓	....	....	.
32	Centre,	Bellefonte,	John Harris,	61.67	78.48	65.27	89.00	47.00	68.47	3⅔	....	....	.
33	Potter,												
34	M'Kean,	Smithport,	Richard Chadwick,	53.43	75.79	51.05	89.00	36.00	60.08	⅓	....	....	.
35	Clearfield,												
36	Cambria,	Ebensburgh,	Richard Lewis,										
37	Bedford,	Bedford,	Samuel Brown,	69.53	73.13	71.45	80.60	61.60	71.36	.	....	....	.
38	Somerset,	Somerset,	George Mowry,	61.19	7[illegible].08	69.98	81.00	45.00	64.42	⅓	38.00	54.78	.
39	Indiana,	Indiana,	Richard White,	70.87	77.77	69.17	89.00	47.00	69.57	.	31.00	47.90	.
40	Jefferson,	Rose Cottage,	C. C. Gaskell,										
41	Warren,	Warren,	C. S. Brown,	63.20	73.33	71.27	84.00	51.00	69.27	.	49.00	62.05	.
42	Venango,	Franklin,	Wm. Connely,	57.63	81.93	65.03	97.00	56.00	68.20	.	....	....	.
43	Armstrong,												
44	Westmoreland,												
45	Fayette,	Uniontown,	J. P. Weithers,	64.92	82.93	65.73	94.00	46.00	71.19	.	....	....	.
46	Green,												
47	Washington,	Cannonsburg,	Jno. H. Kennedy,										
48	Alleghany,	Pittsburgh,	G. P. Schiveley,										
49	Beaver,	Beaver,	Wm. Allison,	66.32	80.69	65.00	91.00	45.00	70.67	1	....	....	.
50	Butler,	Butler,	Jacob Mechling,	63.67	76.70	69.30	87.00	49.00	69.89	.	....	....	.
51	Mercer,	West Greenfield,	S. Campbell,										
52	Crawford,	Meadville,	J. Limber,	67.14	76.24	66.21	88.00	53.00	69.86	1⅔	44.00	56.14	2
53	Erie,	Erie,	Park & Reid,	67.17	73.65	65.23	83.50	59.00	68.68	.	42.00	56.93	.

No.	County.	Barom. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Weather. Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.
1	Philadelphia,	30.03	30.02	30.01	30.31	....	....	.	20⅓	8⅔	1	....	....	....	..	....
3	Bucks,	29.94	29.97	29.94	30.23	29.59	29.95	.	17	12⅓	⅔	9	....	....	..	6.584
5	Northampton,	....	....	....	....	....	....	.	.	.	.	....	....	....	..	......
6	Monroe,	29.48	29.50	29.46	29.65	29.20	29.48	14⅔	3⅔	10⅔	15⅔	....	....	....	..	......
12	Berks,	29.82	29.82	29.81	30.10	29.48	29.82	.	14	16	.	....	....	....	..	1.290
14	Delaware,	29.45	29.44	29.46	29.78	29.12	29.45	2⅓	10⅔	17	2⅓	....	....	....	..	......
15	Lancaster,	29.47	29.47	29.47	29.81	29.13	29.47	.	19	11	.	7	....	....	4	3.715
19	Northumberland,	29.44	29.41	29.42	29.77	29.08	29.42	.	9⅔	20⅓	.	8	....	....	4	1.710
26	Juniata,	29.45	29.38	29.40	29.78	29.11	29.41	3	9⅔	16⅔	3⅔	....	....	....	..	3.900
28	Cumberland,	29.38	29.36	29.36	29.68	29.04	29.37	.	16	14	.	10	....	....	..	2.069
29	Adams,	29.39	29.38	29.38	29.67	29.07	29.38	.	19	11	.	8	....	....	1	2.381
31	Huntingdon,	29.35	29.32	29.33	29.66	29.00	29.33	⅓	19	11	.	7	....	....	2	4.536
32	Centre,	29.25	29.23	29.26	29.57	29.02	29.25	3⅔	12⅓	14	3⅔	....	....	....	..	6.073
34	M'Kean,	28.14	28.13	28.14	28.80	27.95	28.14	⅓	13⅓	16⅓	⅓	11	....	....	1	3.935
37	Bedford,	29.33	29.33	29.33	29.61	28.96	29.33	.	16	14	.	.	....	....	..	......
38	Somerset,	27.95	27.94	27.94	28.19	27.70	27.94	⅓	10⅔	19	⅓	4	...	....	7	[illegible].056
39	Indiana,	28.61	28.61	28.60	28.90	28.30	28.61	.	19	11	.	8	....	....	5	4.716
41	Warren,	28.86	28.83	28.83	29.15	28.49	28.84	.	20	10	.	9	....	...	5	4.812
42	Venango,	....	29.00	....	29.70	28.56	29.00	22⅓	6	1⅔	22⅓	9	....	....	..	5.720
45	Fayette,	28.99	28.98	28.95	29.26	28.60	28.97	.	24⅓	5⅔	.	8	....	....	..	3.820
49	Beaver,	29.41	29.40	29.39	29.76	29.10	29.4[illegible]	⅓	16⅔	12⅔	⅔	6	....	....	..	4.080
50	Butler,	28.82	28.82	28.82	29.10	28.50	28.82	.	.	.	.	5	....	....	2	3.06[illegible]
52	Crawford,	28.77	28.77	28.78	29.13	28.46	28.77	⅔	12⅔	16⅔	⅔	12	....	....	3	5.098
53	Erie,	29.39	29.38	29.36	29.74	29.03	29.38	.	16⅓	13⅔	.	6	....	....	1	5.790

No.	County.	Winds. North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Hygrom. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
1	Philadelphia,	⅔	.	5⅓	⅓	⅔	.	1	.	4	1⅓	4⅔	⅔	3	1⅓	5⅔	.	.	1½	....	.	....	....	.	[illegible]
3	Bucks,	⅓	.	1⅔	2	.	.	1	1	2	1	6⅓	1	2	1	9	⅔	⅓	⅔	....	.	.....	....	.	1175
5	Northampton,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	....	.	.....	....	.	1159
6	Monroe,	2⅓	.	⅓	.	1⅓	.	3	.	⅓	.	2⅓	.	2⅓	.	3⅓	.	⅔	14	....	.	.....	....	.	[illegible]
12	Berks,	.	.	1	⅓	⅔	⅓	2⅔	.	1	.	1⅔	.	5⅓	⅔	14⅔	.	1⅔	.	....	.	.....	....	.	[illegible]
14	Delaware,	2	⅔	1⅓	⅔	2⅓	.	.	⅓	1	1	5⅓	⅓	4⅓	2	2⅓	⅓	3½	2⅓	56.62	6	.....	....	.	1111
15	Lancaster,	3	.	1⅔	.	4	⅓	2	1	2⅓	2	4⅓	⅓	2⅔	1⅓	3⅓	1⅓	.	.	62.86	.	.....	66.5[illegible]	.	[illegible]
19	Northumberland,	2⅔	.	1⅔	.	3	.	3	⅓	6⅓	.	⅓	⅓	4	.	5⅔	⅓	2⅓	.	....	.	.....	[illegible].75	.	[illegible]
26	Juniata,	⅓	.	⅔	.	1	.	2⅔	.	.	.	2⅓	.	2⅔	.	5⅓	.	[illegible]	2⅓	....	.	....	....	.	[illegible]
28	Cumberland,	⅓	⅓	1⅓	.	1⅔	.	⅓	.	1⅔	.	2⅔	.	7⅔	⅓	3⅔	.	1	.	....	.	.....	....	.	[illegible]
29	Adams,	4⅔	.	2⅔	.	.	.	.	.	2⅔	1⅔	3⅔	1	4⅓	⅓	3⅓	⅓	5	⅓	51.94	12	.....	65.11	12	[illegible]
31	Huntingdon,	.	.	.	.	11	.	.	.	.	.	.	.	13⅔	.	.	.	.	⅓	....	.	.....	....	.	[illegible]
32	Centre,	1	.	2⅓	.	2	.	2⅔	.	⅔	.	7⅓	.	3⅓	.	6⅓	.	.	⅓	....	.	.....	...	.	[illegible]
34	M'Kean,	⅓	.	.	.	2	.	3⅓	.	.	.	8	.	10⅔	.	3⅔	.	.	2	....	.	.....	70.[illegible]	1	[illegible]
37	Bedford,	1	.	.	.	⅓	.	2⅔	1⅓	6⅔	.	⅓	.	14⅔	⅓	2⅔	.	.	.	....	.	...	....	.	[illegible]
38	Somerset,	⅓	.	1	.	.	.	1⅓	.	⅔	.	8⅔	⅓	2⅓	1⅓	2⅓	.	1⅓	⅓	....	.	.....	....	.	[illegible]
39	Indiana,	.	.	.	.	⅓	.	2	.	⅓	.	5	.	2⅔	.	6⅔	.	1⅔	.	....	.	...	....	.	[illegible]
41	Warren,	⅓	⅓	1⅓	.	.	.	4⅓	.	1	⅓	6⅓	⅓	1⅔	.	2⅓	.	10⅔	.	....	.	....	....	.	[illegible]
42	Venango,	.	.	.	.	.	.	1⅓	.	.	.	.	.	.	.	6	.	.	22⅓	....	.	.....	....	.	[illegible]
45	Fayette,	3⅓	.	2⅔	.	.	.	⅔	.	1[illegible]	.	12⅔	.	3	.	3⅔	.	2⅓	.	....	.	.....	....	.	[illegible]
49	Beaver,	⅓	.	3	⅔	.	.	.	.	.	.	3	1⅔	⅓	⅔	12	.	7	1⅓	....	.	.....	....	.	[illegible]
50	Butler,	.	.	⅓	.	7	.	1⅔	.	⅔	.	8⅓	.	7	.	5	.	.	.	....	.	.....	....	.	[illegible]
52	Crawford,	2	.	.	.	1⅔	.	⅓	⅓	5⅓	⅓	3⅓	⅓	3⅓	⅓	8	.	3	1⅔	....	.	.....	....	.	1112
53	Erie,	⅓	1	1⅓	.	.	.	⅓	1⅓	3⅔	⅓	1⅔	⅔	7⅓	1	3	1	7	.	....	.	.....	....	.	[illegible]

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